

# Introduction

In January of 1998, The City of Seattle Department of Parks and Recreation (DPR) convened a group of in-house experts in landscape maintenance, horticulture and urban forestry to develop best management practices (BMPs) for these operations in Seattle Parks. This project was undertaken at the request of the Superintendent of Parks and Recreation and in response to the City's Environmental Management Initiative. This manual provides the insights and management practices determined through this project.

In this manual, best management practices or BMPs are defined as **a clear and consistent set of directions to DPR staff for the management and maintenance of resource areas and the individual assets contained within those areas.** Resource areas within Seattle parks include landscape, horticultural, and urban forest categories.

DPR, through its staff, is charged with responsibility as primary steward of vast and valuable resources.

The Department manages nearly 7,000 acres of City property. Approximately 2,300 acres are developed with amenities like athletic fields, play areas, lawns, and ornamental plant beds. The remaining acreage is natural area that when combined with the developed parks comprises an urban forest of over 1,200,000 trees. City parklands also include about 760 acres of urban watershed within which flow more than 8 miles of streams capable of supporting salmon and trout. DPR responsibility also extends to more than 24 miles of freshwater and saltwater shoreline. Each of these resource areas can be viewed as individual ecosystems containing assets such as trees, wildlife, ornamental plant beds and turf requiring thoughtful stewardship.

As the largest landowner in the City, DPR has the opportunity to be a leader in promulgating sound practices for managing its resources. It is critical that the Department carries out this stewardship in a consistent manner regardless of geographic or jurisdictional boundary. As greater numbers of citizens join DPR in maintenance activities, the need for a consistent application of management practices becomes even more important. This manual will also help elected officials and community groups better understand the complexities of resource maintenance.

# About This Manual

This manual establishes clear guidelines for maintenance practices and materials for the City of Seattle Department of Parks and Recreation's landscape, horticulture and urban forestry operations. The manual is structured in this way:

- White pages: BMPs for each management or resource area are presented in nine sections.
- Green pages: Policy guidance on water shortage contingency planning, chemical use and landscape, horticulture and urban forestry management appear as appendices to key sections printed on green paper.
- Yellow pages: Pertinent City of Seattle Standard Construction and Materials Specifications for key resources are placed at the end of the section where they apply and are printed on yellow paper.

Each section of the manual contains the following information:

- **Statement of Purpose**: Basic information about the resource or operation.
- **Definitions**: Key terms are explained.
- **Background**: Important statistical and past practice information is provided to establish the context for the BMPs.

Sections for support and maintenance operations categories also contain the following information:

- **Maintenance Practices**: These are BMPs for what would typically be called routine maintenance such as mowing or edging turf.
- **Cultural Care**: These are BMPs for what would typically be called preventive maintenance. These activities are done to prolong the life and usefulness of the asset such as removing diseased wood from trees and fertilizing plant beds.
- **IPM**: These are BMPs for the Integrated Pest Management pertinent to a resource area or operation.

The wording of this manual has been carefully selected. "Shall and will" have been selected to indicate those activities that are performed as management practice. The verb "should" prescribes practices the Department should be performing to adequately care for the resources base. However, not all the practices prescribed can be performed—or performed all the time—given budget

constraints. It is important that this manual be clear in this area. At the same time, it is hoped this document will help delineate over time those critical maintenance operations that should receive greater funding consideration.

# 1. Construction Site Management

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## 1.1 Purpose



The purpose of this section is to identify the management practices that should be employed at construction sites to guarantee a successful project both at completion and across a lifetime of site use and maintenance. The Department of Parks and Recreation (DPR) manages construction sites to preserve existing vegetation and infrastructure for several reasons:

- To sustain both the function and value of vegetation assets
- To enhance public safety by carefully maintaining the health of onsite vegetation and to reduce liability
- To reduce or avoid soil compaction and degradation
- To avoid physical injury to existing trees
- To avoid root injury to trees and other vegetation
- To protect soils and hydraulic integrity of the entire site
- To protect existing irrigation and underground drainage.

## 1.2 Definitions



**construction site management:** refers to the proper management of construction activities to preserve living and non-living elements of the ecological, environmental, aesthetic, and social landscape. For landscape maintenance, construction site management consists of BMPs employed during three phases of site development: pre-construction, construction, and post-development. These include BMPs for soils, shrubs, trees, drainage patterns, and irrigation systems. Tree preservation is a special concern during construction because tree roots can often extend throughout an entire site.

**"Dial-Before-You-Dig":** a statewide system is in place to allow contractors to locate underground utilities before construction. This contact is mandatory. The phone number is **1-800-424-5555**.

**District Gardener:** the Senior Gardener assigned to each of the department's Park Resource Districts.

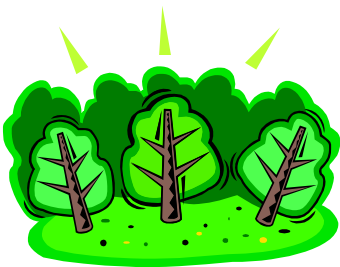
**Senior Urban Forester:** the person who heads the Urban Forestry Unit of the DPR. The senior urban forester is first point of contact on issues related to trees.

**project manager:** refers to either the person assigned by DPR or the contractor who is responsible for managing the overall project. Project management duties include schedule, budget, and related logistics.

### 1.3 Background

Many problems encountered in landscape maintenance can be traced to poor management of original construction. If construction equipment improperly strikes or grades over vegetation, those plants often suffer or die. If a site's soil is overly compacted or contaminated, it will not allow the air and water movement essential to good health. If hydrologic processes on site are disrupted, the site may forever have drainage problems. These and other construction-related impacts can produce long-term maintenance problems that can be avoided by following the BMPs set forth in the remainder of this section.

### 1.4 Pre-Construction



#### Planning

- Know the development and building regulations concerning trees and vegetation in the area.
- The project manager will contact "Dial-Before-You-Dig" (1-800-424-5555) to locate any underground utilities onsite.
- The Senior Urban Forester (SUF) will be responsible for decisions related to vegetation on site before and during removal.
- Before construction begins, the site shall be inventoried. Site inventory includes determining size, species, numbers, and numbers of trees/plants on site and locating irrigation and drainage systems.
- Ensure that irrigation and drainage systems are operable and adequate.
- Protect natural water flows and drainage patterns.

#### Construction Site Preparation

- Staging areas for equipment shall be established far enough from plant material so that plants and their roots are protected.
- Entry and exit routes shall be established and fenced off with chain link or construction fencing. When planning routes, avoid utility access corridors.
- Chain-link fencing or a similar barrier shall be installed around all vegetation that will remain onsite. At the discretion of the SUF, the fencing shall be installed at least as far out as the drip line of the existing trees or farther. These fenced and protected areas are known as "vegetation protection areas."

# 1. Construction Site Management

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The following areas shall be mulched with 12 to 18 inches of chips, hogfuel, or other acceptable material if the SUF recommends protection. The material must be removed from these areas when construction is complete:



- a. vegetation protection areas
  - b. entry or exit routes
  - c. staging areas
  - d. areas near existing irrigation systems
  - e. high equipment use areas.
- Protect irrigation and drainage systems onsite.
  - Prune, clean, and remove deadwood from trees and plants as directed by SUF.
  - Fertilize existing plants and trees at the direction of the SUF.

## 1.5 Construction



- Monitor construction with sufficient frequency to ensure compliance with specifications.
- Locate cement washout pits and chemical holding areas away from vegetation protection areas.
- Limit site parking and material storage to already damaged areas away from tree roots.
- Allow no site offices, equipment, or material storage in vegetation protection areas.
- Control and minimize grade changes within vegetation protection areas. Generally, no changes in grade shall occur within the drip line of any tree to remain on site. This area may be increased at the discretion of the SUF. If the grade must be raised around a desired tree, a dry well shall be constructed around the tree at the drip line or some point farther out.
- Keep refueling and maintenance areas away from trees and native soils. In general, fuel spills will not be tolerated on construction sites.
- Control utility overhead and underground corridors. Tunneling under root zones is preferable to trenching in root areas near trees.

- Use tree protection barriers, wraps, and pads when working near trees. Keep these safeguards in good repair.
- To the extent possible, keep construction equipment away from all onsite vegetation, especially those within designated protection areas.

### 1.6 Post-Construction Cultural Care



Maintaining existing and establishing new vegetation are the primary focus following construction. This cultural care requires identifying problems and treatments that may preserve these resources. If warranted, severely damaged vegetation should quickly be removed and replaced with new plantings.

The following cultural practices can preserve trees:

- Weekly water management (most important item).
- Ensure contractor compliance with plant establishment warranty period.
- Fertilizing with an appropriate product, as needed.
- Wait one growing season for minimal nitrogen applications. Maintain levels for 3 to 5 years.
- Maintain a depth of 2 to 3 inches of mulch around trees and new plantings.
- If the SUF questions the structural integrity of a tree, remove it immediately.
- Watch closely for pests and changes in tree structure. Preventative treatments may be advisable.
- Maintenance staff shall closely monitor and inspect all new construction throughout the warranty period to ensure plant establishment.
- Special emphasis will be placed on weed control during the plant establishment period (3 to 5 years).

# 1. Construction Site Management

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## 1.7 Training



- Provide training to all construction personnel to make sure they understand all construction site BMPs.
- The SUF and District Gardeners shall receive the most recent training and education dealing with construction site management. This training includes the most recent advances for protecting trees on construction sites.
- Urban Forestry and Senior Gardening staff should receive training in appraising and evaluating tree and plant damage according to International Society for Arboriculture standards.

## 2. Water Management

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### 2.1 Purpose



Managing water resources is an important part of overseeing the Department of Parks and Recreation's (DPR's) landscape assets. Turf, shrubs and trees all require water to live, but not all require the same amounts. Our use of water must not only consider the preservation of landscape assets but also the impact on fish in our watersheds. An efficient irrigation program makes the best use of the resource by not wasting water vital to other natural resources such as fish while at the same time preserving landscape assets.

The design and programming of irrigation systems is complex. It requires knowledge of basic hydraulics, site conditions such as soils, slopes and plants, and a knowledge of the irrigation system tools themselves. As competition for available water becomes more acute, the department will have to be equally dedicated to carefully managing this resource.

### 2.2 Definitions

**water management:** term for the efficient use of supplemental irrigation water required for most landscapes in the Puget Sound region. By controlling the application of water used for irrigation, water management conserves this resource, reduces urban runoff, and saves money—three important goals of the Department of Parks and Recreation (DPR).

### 2.3 Background

Best management practices for irrigation system operations combine activities for maximizing a range of technologies for water control and common field practices.

#### **Irrigated Park Areas**

Because DPR's mission is to preserve all landscape assets, many landscape areas are irrigated, including the following:

- Athletic fields
- Bathing beaches
- Golf greens, tees, and fairways
- High-use or high-visibility turf plantings like picnic areas, play areas, wading pools and community center lawns
- Most shrub and annual plant beds

- Newly installed landscapes
- Most areas in high-use or high-visibility parks (Freeway, Volunteer, Commodore and others)
- Portions of most neighborhood parks and playgrounds
- Special gardens.

### **Non-Irrigated Park Areas**

The following DPR facilities are not irrigated:

- Low-use or low-visibility park turf areas
- Turf meadow areas
- Natural areas.

## 2.4 Design

Irrigation design is the foundation of sound water management. The design process involves first determining which parks to irrigate, deciding next which systems to automate, and finally selecting the best automatic control options.

### **Determining which Parks to Irrigate**

The Department has many parks or park areas with no, or substandard, irrigations systems. In some cases, it is desirable to irrigate these parks and in others cases it is not necessary. While water management will always contain gray areas, determining whether a park should be irrigated is based on the following considerations:

- Visibility and intensity of use
- Expectations of neighbors and park users
- Existing condition of irrigation infrastructure
- Value of landscape assets (particularly those with unique horticultural, historical or aesthetic significance).
- New landscape areas requiring "establishment irrigation"
- Alterations to landscape that could reduce the need to irrigate.

## 2. Water Management

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### **Determining which Irrigation Systems to Automate**

Ideally, all irrigation systems should be automated. Because automation is costly, DPR sets priorities for automating systems. Use the following criteria when considering converting a system from manual to automatic. A "yes" answer to any of the following questions is an indication the system should be automated:

- Does the park have an existing semi-automatic system (easily automated)?
- Does the park have athletic field(s)?
- Does the park have high visibility or use?
- Is the existing irrigation system or landscape slated for replacement?
- Does the existing manual system require excessive amounts of labor to operate, including moving multiple lengths of hose around the park?

Because they are easy and cost-effective to convert, existing, semi-automatic systems should be given highest priority. The DPR recommends that all these systems be targeted for automation regardless of park size. Some small parks can use battery- or solar-powered controllers.

Any new or renovated system should be designed for eventual automation, including connection to a central computer control system.

### **Providing Manual Backup for System Operation**

All newly designed or renovated automatic irrigation systems should have manual backup capacity for operation in the event of a breakdown for failure in the automatic system.

### **Choosing an Automatic Irrigation Control Option**

DPR employs a variety of controllers for timing the application of irrigation water. These automatic controllers serve three primary purposes:

1. Operate remotely rather than manually, saving labor hours and water
2. Accurately time irrigation to specific needs of soils, slopes and plants
3. Reduce impacts to park use and water loss to evaporation by operating at night

### Types of Irrigation Controllers used in Seattle Parks

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Mechanical

Solid State

Battery Powered

Solar Powered

Maxicom™

**Mechanical Controllers.** Mechanical controllers employ an electric clock programmed by a set of pushpins. Mechanical systems were the first automatic irrigation controllers used by the DPR and are still in operation today. They turn a system on and off by irrigation zone for set amounts of time each day. While relatively easy to use, mechanical systems are limited in their ability to meet today's water management needs for flexibility in programming the application of water.

**Solid State Controllers.** These controllers use solid state circuitry. Advantages of solid state controllers include relatively low cost, significant programming flexibility and ease of repair. The only disadvantage of these controllers is that solid state operates as an individual unit, thereby lacking the savings potential of central computer control. Solid state is the preferred controller for parks that will not be connected to central control.

**Battery-Operated Controllers.** Battery-operated controllers are either mechanical or solid state controllers that operate off batteries. They are typically used at locations where automatic irrigation is desirable but access to electric power is not feasible. The DPR uses very few of these devices currently. Advantages of these systems are their reduced labor costs, ease of operation, and limited need for training. We recommend that DPR invest in more of these devices for use at small sites with existing semi-automatic systems.

**Solar-Powered Controllers.** As the name suggests, these controllers use the sun as their power source. The environmental benefits of solar-powered controllers, which are typically installed at small sites, are obvious. The application of these controllers is limited because of potential vandalism to their working parts, which must have open solar access. These controllers also cannot be linked to central control.

**Maxicom™.** Maxicom is the brand name for a centralized computer-controlled irrigation system DPR uses at those parks where linkages are possible. Maxicom allows remote irrigation systems to be programmed. It monitors water use within individual systems and can detect problems and pinpoint them for repair. Because the system is linked to a weather station, it can be programmed to



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withhold water on rainy days. Maxicom can also shut the system off when soil moisture levels indicate watering is not needed.

Maxicom also employs various sensors such as flow meters and sub-meters within the irrigation systems. These built-in water meters very accurately determine where water is being used and where there may be problems.

### Using Maxicom Control

In an ideal world, all automatic systems would be operated through centralized computer controls. However, it costs about \$5,000 in hardware to put a system on Maxicom plus ongoing charges for phone modem connections. The return on investment for small sites would be many years. Mini-parks, squares, places and triangles are probably best left to onsite automatic irrigation control. Similar consideration should be given to static sites such as special gardens where gardeners are on-site and where site-specific water control may be best for certain plant collections.

Use of Maxicom for medium to large parks and athletic fields is very important and should continue to be a high priority. DPR ultimately plans for five Maxicom units at the following parks:

- Woodland Park Zoo (in place)
- Jefferson Park Golf (in place)
- Interstate-90 Park properties (in place)
- One in each geographic division: north, central, south.

**DPR prefers automatic irrigation controllers be installed in the following order of priority:**

### Priority List for Installing Automatic Irrigation Controllers

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Maxicom™	central computer control
Solid State	stand alone
Mechanical	stand alone
Battery-Powered	stand alone
Solar-Powered	stand alone

The addition of more automatic controllers will ultimately require some increase in maintenance resources.

## 2.4 Installing Irrigation Systems

All new irrigation systems, and system renovations shall be designed and installed according to DPR standard specifications. (See the *Seattle Department of Parks and Recreation Standard Specifications* for water management. They are printed on the yellow pages at the end of this section). To the extent possible, standard material and products will be used to increase ease of maintenance and reduce inventory confusion.

## 2.5 Adding or Removing Irrigation from a Park

Some agencies install irrigation systems with the intent that they may be turned off during extreme drought. Some agencies also install systems to establish landscapes, then eventually phase out irrigation. The advantage to this approach is that the system is always in place to deal with future drought conditions or to help establish new additions to the landscape.

When weighing whether to add or remove irrigation from a park, the decisionmaking process needs to be collaborative. Contact the Division management, the Park Horticulturist, Department design services and, to the extent necessary, the community when adding or removing irrigation from a park.

## 2.6 Programming Automatic Irrigation Controllers

Programming automatic irrigation controllers relies more on the art of understanding a site and its plant materials than the science of the system itself. DPR recommends that senior gardening staff program controllers. A Senior Gardener will normally be assisted by and work closely with others, such as plumbing staff and athletic field coordinators. The basics a Senior Gardener must know for programming a controller are listed in the table on the next page:

## 2. Water Management

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To Program a Non-Maxicom Automatic Irrigation Controller:

Component	You Should Know:
<b>Irrigation System</b>	<ul style="list-style-type: none"><li>• <b>Daily amount of water discharged.</b> Most important is the amount of water the system discharges in gallons per minute (gpm) and how that translates into “inches of water per week.”</li><li>• <b>Daily multiple programming ability.</b> Some controllers allow for multiple programming daily; others don't. Certain sites, such as those with steep slopes, may require multiple programming.</li><li>• <b>Capabilities of each system.</b> Each type of controller operates slightly differently. Know enough about the variety of products and their operation to select among them.</li></ul>
<b>Site Conditions</b>	<ul style="list-style-type: none"><li>• <b>Soil conditions.</b> Watering regimen differs from soil to soil. Sandy soils drain much faster than clay soils. Clay soils often will not absorb water very quickly.</li><li>• <b>Topography.</b> The more sloped the site, the greater the potential for runoff.</li><li>• <b>Watering requirements of plants.</b> Most sites are designed so that plants with similar water needs are grouped. Most lawns are on separate irrigation “zones” from plant beds because their watering needs differ.</li></ul>
<b>Other Info</b>	<ul style="list-style-type: none"><li>• <b>Uses of site.</b> Know how a site is used, including type of use, intensity, misuse potential (vandalism).</li><li>• <b>Various quirks in system or local water service.</b> For instance, it may not be possible to get sufficient water volume during certain times of the day.</li><li>• <b>Fundamental problems with system itself.</b> Check for and correct the following:<ul style="list-style-type: none"><li>-If the system has heads that are unsuited to the site</li><li>-If the controller needs capacity for multiple daily programming.</li></ul></li></ul>

The Maxicom™ system, while a great tool, is complicated. Only highly trained staff should program Maxicom controllers.

**To Operate Maxicom™ Systems:**

Step	Activity
1.	Program the computer with site-specific information. This data is obtained through an on-site audit. This audit might be best done as a contracted service because staff time is often not available for such time-intensive processes.
2.	Train the selected staff that will have access to the system. A certification course is available that staff will need to attend and complete. There are several levels of certification. In addition to this basic training, the selected staff will also need to attend additional training as the system evolves and changes.
3.	Make sure the: <ul style="list-style-type: none"> <li>• Weather station is up and operating</li> <li>• Evapotranspiration information is accurate</li> <li>• Various flow sensors and other system hardware are operational.</li> </ul>
4.	The fourth step is actual system operation. The system needs to be regularly monitored and followed-up, including writing work orders for system repairs.
5.	The fifth step is maintaining documentation of the actual water use. Maxicom should, over time, show a reduction in water use at those sites where it operates and where DPR has irrigated regularly in the past.

## 2.7 Cultural Care of Plants and Turf

The following are preventive maintenance procedures for irrigation system operations:

- Research the water use needs of the turf, shrubs, and trees to be irrigated. Apply no more water each week than required to sustain healthy plants.
- For turf areas, a general rule of thumb is no more than 1 inch of irrigation water per week, including rainwater.
- When watering turf, water less often (1 – 3 times per week) and for longer periods to promote deep rooting. Deep rooting leads to healthier, more drought-tolerant grass.
- Consider plant species and age when programming the irrigation controller or when applying water manually.
- Site topography plays an important role in irrigation timing. Given their potential for runoff, sloped sites may require multiple applications of irrigation water in shorter timing cycles than required for flat sites.

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- Soil also plays an important role in irrigation. Heavier, clay-type soils cannot be watered as long during each watering cycle as can sandy soils. Soil conditions should be considered—particularly in turf areas with heavy use.
- On turf and planted areas, aerate and cultivate to relieve soil compaction and increase water uptake.
- Wherever possible, avoid watering during the hottest part of the day.
- Prevent overwatering. Manually operated systems shall not be operated at night unless staff is present or unless the system has an automatic shut-off valve.
- Staff shall not allow manually operated systems to apply water longer than needed. The system shall not be turned on in the morning and turned off at the end of the day for convenience.
- Special attention shall be paid to verify that manually operated sprinklers are actually watering the landscape and not streets or other non-landscape areas.
- A water budget should be determined for each site. Irrigation controllers shall be set to water only the budgeted amount.
- Monitor the application of irrigation water carefully to determine when controller settings can be reduced to save water and to reduce runoff.
- To the extent possible, and in concert with DPR irrigation plans, incrementally reduce watering in late summer/early fall. The amount of water available in City reservoirs is greatly reduced at that time of year.
- A complete system audit should be completed on a 5-year cycle.
- Develop a resource management system for irrigation operations. This system would provide a database from which programming records can be retrieved for annual system reprogramming to avoid starting from scratch.

### 2.8 Irrigation System Maintenance

- Visually check the system to make sure it is operating properly.
- Perform annual preventive maintenance on heads, valves and controllers.
- Repair the system **promptly** to reduce water loss.
- Make sure heads are set at the proper grade and properly aligned.
- Make sure valves are operating properly.

- Use the system winterization and de-winterization processes as opportunities to make complete system visual checks.
- Keep grass trimmed away from heads to allow proper functioning.
- Clean heads as needed to ensure optimum performance.

## 2.9 Upgrades and Replacements

- The existing inventory of the condition of all DPR irrigation systems shall be maintained and updated.
- A replacement program (major maintenance program) is needed to ensure timely upgrading or replacement of old systems. The existing irrigation system major maintenance replacement program shall be maintained to provide priority-based direction for replacement funding.

## 2.10 Training

Staff training is required in several areas:

### Basic Water Conservation

All park resources staff should receive training on basic water conservation as part of an overall training program in environmental management. DPR staff or the Water Department can provide this training.

### Mechanical and Solid State Controllers

Programmers for the system are required to become familiar with the unique qualities of each controller. This training should be scheduled when controllers are installed. Training should include the Senior Gardener and plumbing staff.

### Maxicom™

Operation of the Maxicom system requires training and certification. This training is provided by outside vendors.

### Water Budget Training

It is likely that water budgets will be required in the future for park locations not tied into Maxicom. Selected staff will need training in how to establish water budgets for park sites and in water auditing. This training is regularly available through several sources including the Water Department.



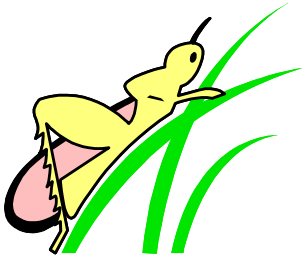
### 2.11 Water Shortage Contingency Plan

- A draft plan, *Water Shortage Contingency Plan for Drought and Emergency Demand Reduction*, developed in 1995 lays out clear policy for responding to drought. It is located in the green pages at the end of this chapter. Following formal DPR review and approval, this plan, as amended, needs to be made an essential part of this BMP manual.

## 3. Integrated Pest Management

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### 3.1 Goals and Philosophy



Parks and other public landscapes provide many Seattle residents with their only access to green spaces, to outdoor recreational opportunities and the natural environment. Seattle has nearly 12,000 acres of managed landscaped area. These parks, gardens, streetscapes, library grounds and greenbelts are important to the mental and physical health of the community. Collectively, they are a heritage of significant value dating back more than 115 years. The citizens of Seattle, through the neighborhood planning process and other involvement, have documented their concern that these public assets be well maintained.

The landscape assets within City parks—trees, shrubs, turf and natural areas—are all susceptible to threat from a variety of pests. No landscape either developed or natural is immune from pest attack. It is important that the City manage pests in order to:

- protect the health and value of landscape assets
- ensure an intact, public landscape legacy into the new millennium
- preserve and enhance the City's environment and natural ecosystems
- provide parks and other public landscapes that are attractive and meet the expectations of thousands of users

The philosophy that guides the Department of Park and Recreation's (DPR's) approach to pest management is the following:

*Careful consideration of all options available within the context of Integrated Pest Management (IPM) and budget realities, with control of serious pests the goal when needed, and with an emphasis on nonchemical controls whenever possible.*

### 3.2 Definitions

**best management practice (BMP):** In this manual, best management practice or BMP is defined as a clear and consistent set of directions to DPR staff for the management and maintenance of resource areas and the individual assets contained within those areas. Resource areas within City of Seattle parklands include landscape, horticultural, and urban forest categories.

**Integrated Pest Management.** A decision-making process to determine if, where, when and how pest problems will be managed. An IPM program includes all potential pest control strategies but focuses on nonchemical controls whenever possible. The following four pest control methods may be employed in an IPM program:

- **cultural control:** The use of sound horticultural practices to optimize plant health and to suppress insects, disease, and weed growth. Other cultural controls include site-appropriate design and the use of disease or drought-resistant plants.
- **mechanical control:** The use of a variety of tools and equipment for the purpose of eliminating pests.
- **biological control:** The use of biological control agents that act as predators or parasites of pest species. The use of other beneficial organisms that improve plant health by enhancing soil quality.
- **chemical control:** The application of various agricultural products such as herbicides, insecticides or fungicides or other chemical compounds to a target pest as a means of control.

**MSDS:** Material Safety Data Sheets or MSDS are prepared by manufacturers of chemical products to relay the necessary safety and protective information to users.

**pesticide:** Any material including agricultural chemicals, herbicides, insecticides and fungicides, or biological agents such as *Bacillus Thuringiensis* "BT" applied to a target pest as a control measure.

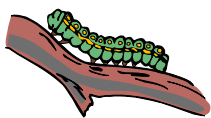
**pest:** The word "pest" has been broadly defined in this document to include "injurious" insect species, plant pathogens, noxious or invasive vegetation, vertebrate animals such as rodents, structural pests or any other factor that creates an unhealthy environment for landscapes and structures.

**threshold:** The term "threshold" refers to the point at which pest injury can no longer be tolerated without compromising the health or aesthetic value of a plant, ecosystem or other assets of value including human health. Once a threshold is being approached, some control measure may be necessary to suppress pest activity to acceptable levels.

### 3.3 Components of an IPM Program

#### Basic Parts

An IPM program is comprised of six basic parts that work well for a range of facilities, including a nursery, greenhouse, conservatory, golf course, park or athletic field. The following seven steps are typical in IPM programs:



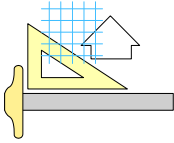
1. **Monitor pest populations.** Research the problem to properly design a precise monitoring program that will provide the data needed to assess the impact of the pest on the host.

### 3. Integrated Pest Management

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2. **Determine injury levels:** Define the tolerance levels for aesthetic and economic injuries. Determine the pest population level that will result in damage beyond the tolerance levels. Prescribe the point at which actions must be taken to avoid exceeding the tolerance level.



3. **Design and implement the pest management program.** Utilize the full range of pest management options. Remember that it might be decided to ignore the pest altogether. Response must consider protection of the pest predator populations. Use of pesticides is limited to situations where other options are not likely to be successful within the context of available resources.



4. **Evaluate results.** Conduct follow-up inspections to support evaluation:

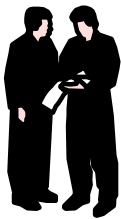
- Did the pest population decline to acceptable levels?
- Was there a negative impact on pest predators or other non-target organisms?
- Do the host plants appear to be able to thrive following a successful treatment?



5. **Adjust and extend program as indicated.** Decide whether further treatment is needed for this episode. Forecast the future of this problem. Plan potential site modifications if it appears that the problem must be treated on an ongoing basis.



6. **Create permanent documentation of all research, monitoring, and application data.** A comprehensive system of forms for monitoring data and documenting treatment is a key component of a successful IPM program.



7. **Share pest management information with decision-makers and maintenance staff.** Professional staff such as landscapes designers, maintenance managers, and public information specialists must know the degree to which landscape pest management programs impact existing staff, maintenance budgets, and park assets. Only through such understanding and ongoing communication can the best long-term strategies be developed for managing pest populations.

#### IPM Control Alternatives Selection Hierarchy

The implementation of DPR's IPM program will generally follow this selection rationale:

- Proper planning and management decisions begin the IPM process.

- Cultural methods of vegetation and pest control are preferred and will be employed next.
- Mechanical means of vegetation and pest control will be employed next where feasible.
- Biological means of vegetation and pest control will be employed next where they are practical and feasible.
- Pesticides will only be used when no other feasible method exists that will control the pest within the realities of the location, site conditions, budget and other relevant considerations. At the same time, it is recognized that pesticide use is a legitimate element of an IPM program, albeit as a last priority.

### 3.4 Pesticide Use Decision Process

The following is the decision process the City employs when determining pesticide use in Seattle Parks.

- The **Office of Environmental Management (OEM)** sets overall policy for pesticide use in the City of Seattle. OEM's authority includes determining whether particular pesticide products will be included in the City of Seattle list of acceptable products. The OEM will normally consult with the departments that have land management responsibilities before making these recommendations.
- The **Park Horticulturist** is DPR's liaison to OEM and has primary responsibility for recommending pesticide policy, procedures and products used within City of Seattle parks to Department Managers, Directors and the Superintendent.
- The **Park Resource Managers, Manager of Golf, Park Resource Crew Chiefs and Golf Course Superintendents** are responsible for applying City and DPR pesticide policies and procedures within their areas of control.
- The **Senior Gardeners** (and other selected staff) determine the most appropriate control measure for actual landscape pest situations, including selecting the most appropriate pesticide product. In golf maintenance, this responsibility rests with the **Golf Course Superintendent** or their immediate assistant.
- The **Hazardous Waste Coordinator** coordinates issues related to hazardous waste. The issues include safe storage and handling of pesticides, removal of outdated pesticides from DPR inventory, hazardous spill response, and related training. This person also inventories all pesticide products that could become hazardous waste.

## 3. Integrated Pest Management

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See Appendix B, the City of Seattle Office of Environmental Management's *Environmental Management Initiative* excerpt "Chemical Use," for more information. Appendix B is located in the green pages at the end of this section.

- The DPR's **Safety and Health Specialist** will work with staff to ensure that any required personal protective equipment (PPE) is available and properly fitted for use by all staff applying pesticides.
- The **Pesticide Recertification Training Committee** is responsible for coordinating the mandatory annual recertification training for all licensed pesticide applicators, officially called "Pesticide Operators."

### 3.5 Pest Management Guidelines

The following pest management guidelines generally apply to all City of Seattle Department of Parks and Recreation landscapes:.

- Park landscapes will be designed to minimize pest management
- Where resources are available and existing design themes will not be compromised, modifying landscapes will be considered to reduce pest management.
- DPR will practice IPM in all pest management situations, understanding that some situations will require the use of a pesticide product.
- Certain levels of pest problems or populations will be accepted within established thresholds. Those thresholds will vary with the pest and the landscape setting.
- All reasonable nonchemical pest control options will be considered first before resorting to the use of pesticides.
- Only pesticides on the City's approved list will be used for the prescribed applications.
- The application of pesticide products will be timed to minimize public contact.
- DPR will not perform prophylactic or calendar-based insecticide applications.
- When pesticides are applied, only the area where the pest problem is occurring will be treated.
- Whenever possible, pesticide applications will be carefully timed to control the pest and reduce the need for re-treatment.

- DPR pesticide applicators will strictly observe all pesticide products label requirements.
- Pesticides will not be used to control plants with edible fruit during the fruiting season unless the plant being controlled is not of sufficient size to produce fruit. Fruiting plants such as blackberries may be first cut to the ground, allowed to re-sprout and then chemically controlled before the plant can produce fruit. Plants controlled in this manner will never be allowed to produce fruit in the future.
- All sites where pesticides have been applied will be posted per Washington State Department of Agriculture (WSDA).
- As required by the WSDA, all applications of pesticides will be recorded.
- When pesticides are used in confined environments such as greenhouses, the facility will be clearly posted "Closed to Entry" until the re-entry time period has elapsed.
- DPR will continue its aggressive training program for all staff who apply pesticides. We will continue to emphasize learning new pest control techniques, as they are available.
- DPR will continue to field test alternative controls to pesticide use and will implement successful control options as budget allows.

## 3.6 Storing and Using Pesticides

Every employee has a personal responsibility to themselves, other staff, and the public to follow safe work practices when storing or using pesticides.

### Management Practices

- Always read the label of the chemical that you will be using.
- Store and handle all chemicals or fertilizers in a manner that minimizes worker exposure and potential for contamination of surface and ground water.
- Always have the correct Material Safety Data Sheet (MSDS) on hand for all chemicals or fertilizers at your site (required by law).
- Always check the MSDS for the type of protection needed and the recommended re-entry time before the chemical is applied.
- When possible, purchase the smallest amount of any pesticide needed and avoid stockpiling of chemicals.

### 3. Integrated Pest Management

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- Store fertilizer in a separate weatherproof area.
- All spray equipment shall be maintained in proper working order and stored in an OSHA-approved site.
- All protective gear (masks, filters, rain gear) will be stored separately from any possible contamination.
- Store and mix all chemicals in a WSDA-approved storage and mixing area. Label storage area with an NFPA-coded sign to protect Fire Department or Hazmat personnel in case of emergency.
- Any pesticides in inventory that are no longer needed for use will be disposed of through hazardous materials disposal practices.
- A computerized pesticide inventory will be developed and maintained by the Hazardous Waste Coordinator.

#### Pesticide Application Equipment

Pesticide application for all listed areas will be carried out by hand with directed, low-volume, single-wand sprayers, wiping, daubing and painting equipment, injection systems, or drop spreaders. Typically, applications are done with backpack sprayers, but may also include sprayers with larger fill tanks providing the same kind of hand application method is used. These methods of delivery result in low-volume applications at low nozzle pressures. This practice minimizes the formation of fine mists that can result in pesticide drift. These practices also help ensure that the pesticide applied will reach only its intended target. Boom type sprayers will be used only in golf course applications and special situations.

#### Personal Protective Equipment (PPE)

The table on the following page shows the personal protective equipment required by City, state and federal regulations for pesticide use.

## Personal Protective Equipment (PPE) Guide for Using Pesticides

Form of Pesticide	LABEL SIGNAL WORD		
	Caution	Warning	Danger
Dry	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> <li>wide-brimmed hat</li> <li>gloves</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> <li>hat</li> <li>gloves</li> <li>cartridge or canister respirator if dusts in air or if label precautionary statement says "Poisonous or fatal if inhaled"</li> </ul>
Liquid	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> <li>wide-brimmed hat</li> <li>gloves</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> <li>wide-brimmed hat</li> <li>rubber gloves</li> <li>goggles if required by label precautionary statement</li> <li>cartridge or canister respirator if label precautionary statement says "Do not breathe vapors or spray mist" or "Poisonous if inhaled"</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>rubber boots</li> <li>wide-brimmed hat</li> <li>rubber gloves or face shield</li> <li>canister respirator if label precautionary statement says "Do not breathe vapors or spray mists," or "Poisonous if inhaled"</li> </ul>
Liquid when mixing	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes and socks</li> <li>wide-brimmed hat</li> <li>gloves</li> <li>rubber apron</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>shoes &amp; socks</li> <li>wide-brimmed hat</li> <li>rubber gloves</li> <li>goggles or face shield;</li> <li>rubber apron</li> <li>Respirator if label precautionary statement says: "Do not breathe vapors or spray mist" or "Poisonous (or fatal or harmful) if inhaled"</li> </ul>	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>rubber boots</li> <li>wide-brimmed hat</li> <li>rubber gloves</li> <li>goggles</li> <li>rubber apron</li> <li>canister respirator</li> </ul>
Liquid (prolonged exposure to spray, or application in enclosed area)	<ul style="list-style-type: none"> <li>long-legged pants</li> <li>long-sleeved shirt</li> <li>boots</li> <li>rubber gloves</li> <li>waterproof wide-brimmed hat</li> </ul>	<ul style="list-style-type: none"> <li>water-repellent long-legged pants &amp; long-sleeved shirt</li> <li>rubber boots</li> <li>rubber gloves</li> <li>rubber apron</li> <li>waterproof wide-brimmed hat</li> <li>face shield</li> <li>cartridge or canister respirator.</li> </ul>	<ul style="list-style-type: none"> <li>waterproof suit</li> <li>rubber boots</li> <li>rubber gloves</li> <li>waterproof hood or wide brimmed hat</li> <li>face shield</li> <li>canister respirator</li> </ul>

## 3. Integrated Pest Management

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### Pesticide Application near Watercourses & Aquatic Habitats

Whenever pesticide products are applied near watercourses, great care will be taken to ensure product does not migrate into the watercourse either through drift or by overland flow. Weather conditions must be monitored carefully to avoid applying a pesticide near a watercourse immediately before heavy rains. Soil conditions and site topography must also be carefully studied to determine either the appropriate timing of a pesticide application **or whether a pesticide should even be applied at the site.** In general, the use of pesticide products in close proximity to a watercourse shall be discouraged in favor of an alternative control method. If a pesticide must be applied in close proximity to a watercourse, only products registered for that use shall be used. These same environmental considerations apply to the use of **fertilizers** near watercourses and aquatic habitats.

### 3.7 IPM Best Management Practices

DPR maintains a wide variety of landscape types. Each type has pest control issues unique to it or common to other landscapes yet requiring different control measures. For these reasons, the pest control measures specific to each landscape are dealt with separately in this section.

#### Control of Special Pests

Several pests found in a variety of DPR landscape types often require control.

- **Horsetail.** One of the most tenacious weeds in Northwest gardens is horsetail. It is almost impossible to control manually or mechanically. Horsetail can be controlled with the herbicide Manage®. As with other chemical controls, the pesticide shall be contained to the area of infestation.
- **Garden Slugs.** As in all Northwest gardens, the control of garden slugs can be important in floral beds in parks. Approved control strategies include manual control and careful use of chemical control products.
- **Rats.** Rats are often a major pest problem in many Seattle parks. Because they pose a human health risk, they must be controlled in many situations. The common method of control is baiting with an approved rat bait. Extreme caution must be taken to place rat bait in locations where people or domestic animals cannot access it.
- **Mice.** Mice are becoming an increasing human health problem from Hanta virus. Mice control is not currently a major pest control issue in DPR facilities, but increased control measures may be required in the future based on the history of the virus.

- **Yellow Jackets, Hornets, and Wasps.** These insects often require control in parks. Control is typically through use of an approved insecticide. Only individual nests are treated.

## Greenhouse Operations

Greenhouses are a production operation dealing with large numbers of plants in a closed, non-public environment. Many of the crops grown or nurtured are exotic, unique and extremely valuable. Because of these factors, the tolerance threshold for many pest problems is much less in the greenhouse or conservatory environment than it is in general park landscapes. While the greenhouse program received a King County Enviro-Star Award in 1998 for progressive IPM implementation, these facilities are nevertheless required to maintain and often use a broader palette of pesticide products.

### Pest Tolerance Thresholds

Because City greenhouses produce great numbers of plants in support of many DPR programs, pest tolerance thresholds are very low. The same is true for the Volunteer Park Conservatory, where much of the plant collection is very rare and of great value.

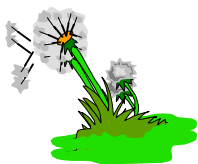
- Weeds are not tolerated in either City greenhouses or its conservatory.
- Insect pests that threaten the health of plant collections or production crops are not tolerated in the greenhouses or conservatory.
- Disease pests that threaten the health of plant collections or production crops are not tolerated in the greenhouses or conservatory.

### BMPs: Pest Management Control Strategies

#### Weed Control

The following are management techniques for weed control in greenhouses or the conservatory.

- Greenhouse operating areas and containers and conservatory display spaces are kept free of weeds through hand/manual weeding.
- Weeds are controlled in exterior spaces, building perimeters, shade houses, cold frames and related areas either by hand or mechanically with push type mowers and string trimmers or suppressed with landscape fabrics.
- Some exterior areas receive pesticide treatments with Roundup Pro® or Surflan® for weed control.



### 3. Integrated Pest Management

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#### **Insect Control**

Insect pests are routinely monitored by visual inspection or the use of “sticky traps.” Populations are kept below injury thresholds by:

- Proper cultural practices including regular irrigating and fertilizing.
- Removal of insects by hand or washing them off the affected parts of the plants.
- Biological controls using beneficial insects and other organisms that attack pest insects. Periodic releases of beneficial insects help to suppress and reduce the need for chemical control.
- Spot treatments of the least toxic, yet effective, insecticide directed at specific plant parts for specific pest control.

#### **Disease Control**

Disease pathogens are controlled by the following methods:



- Provide good sanitation techniques including regular removal of plant debris and keeping tools and work areas clean.
- Provide proper spacing between plants for good air circulation.
- Select disease resistant plants.
- Keep diseased plants away from healthy crops.
- Apply the least toxic, but effective, pesticide product to control specific disease pathogen on a specific plant or crop.

#### **Nursery Operations**

The nursery is a facility for the propagation and growing of plants for use on developed and undeveloped park property. The Atlantic City Nursery occupies roughly six acres of property and has been in continuous operation for more than 30 years. The plants provided by the nursery operation include natives as well as ornamentals, groundcovers, vines, perennials, shrubs and trees. The plants are grown to support various needs throughout the park system from small in-house planting projects to large capital improvement projects. In recent years, the production of native plants has been increased substantially to meet increasing demand, primarily for forest restoration projects. Control of pests in the nursery environment is very important since many plants may be affected at one time.

## Pest Tolerance Thresholds

- Pests that threaten the health of the nursery crops will not be tolerated and will be controlled.

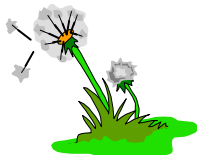
## BMPs: Pest Management Control Strategies

### Surface and Groundwater Protection



- General site runoff is controlled through biofiltration.
- Select the least toxic and most non-leaching chemical products only when necessary. Precisely follow all label instructions.

### Weed Control



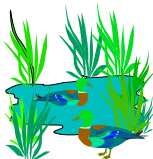
- Most weed control at the nursery is accomplished through hand weeding, mulching and use of landscape fabrics
- When other controls have failed, Roundup Pro® herbicide is used for spot control of weeds.

### Disease Control



- Select disease-resistant plant varieties.
- Monitor plant crops for disease outbreaks.
- Practice good cultural practices including watering, fertilizing, pruning and maintaining good air circulation.
- Reduce the potential for transfer of disease through good sanitation techniques. These practices include keeping growing areas, tools and containers clean and removing plant litter and debris in a timely manner.

### Biological Pest Controls






- Habitat for natural insect pest predators will be encouraged as an environmentally sound means to reduce populations of insect pests.

## Plant Beds

Plant beds are defined as non-turf planted areas that include woody plant material such as shrubs and trees and ground covers. The category also includes floral color displays containing herbaceous plants such as perennials, annuals, and bulbs. The most serious pest management issue in plant beds is weed control. If not controlled, weeds not only make a plant look unkempt but, more importantly, can out-compete desirable landscape plants resulting in a loss of assets. Tables 1 and 2, respectively, show pest tolerance thresholds and IPM principles that shall be employed in selecting maintenance methods for plant beds.

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**Table 1. Pest Tolerance Thresholds for Plant Beds.**

Area	Weeds 	Insects 	Disease 
General Landscape Beds	Some weeds acceptable. Goal is for bed areas to be generally free of weeds for both asset protection and appearance. Weeds will not be allowed to out-compete desirable landscape plants.	Generally tolerated unless particularly valuable plants are actually threatened.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Highly-visible/ Public facility landscapes	Generally not acceptable.	Generally tolerated unless they threaten particularly valuable plants.  Manual removal of obvious pests is encouraged.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Special gardens/ Zoo exhibits	Generally not acceptable.	Generally tolerated but will not be allowed to damage or destroy valuable plants.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Floral beds	Generally not acceptable.	Generally tolerated.	Disease problems tolerated. If disease persists, landscape will be replaced.
Newly-established landscapes	Weed control is very important to ensure complete establishment of desired plants.	Generally tolerated. Presence of pests may result in host plant being removed and replaced.	Disease problems, if minor, will be tolerated. Presence of disease problems may result in host plant removal and replacement.

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## Trees

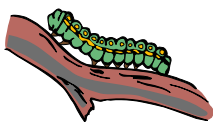
Trees may be located in open turf areas, in shrub beds, or along streets, boulevards or trails. Trees provide shade, clean the air of pollutants, modify both micro and macro climates, and provide visual aesthetics. Trees are assets that should be managed as integral elements of the landscape, whether formal or natural. Their contribution to the landscape shall be considered as part of their best management practices. Because trees are very often large and tall, accessing and managing insect and disease is difficult.

### Pest Tolerance Thresholds

- In general, insect and disease pests in trees are tolerated
- Insect or disease pests in selected, high-value specimen trees may be subject to control measures.

### BMPs: Pest Management Control Strategies

#### Insect Control



DPR does not actively control insect pests in trees. This is particularly true of large trees where the control of the pest might require the use of large aerial spray equipment, which carries with it a high probability of the insecticide applied leaving the area due to wind drift. For example, the Department does not spray aphids despite the "honeydew" problem associated with them. When insect pests are controlled in trees, the following measures are used:

- Trees that are highly susceptible to specific insect pests (such as blue spruce and spruce aphids) may be removed from the landscape and replaced with resistant species.
- When possible, the portion of the tree affected by the insect (such as tent caterpillars) can be physically removed, eliminating the pest.
- An insecticide may be applied to control a specific insect pest in very selected situations. These situations include pests on specimen quality trees at special gardens or in high visibility locations where the presence of the pest threatens the life of the tree. In these situations, general foliar applications will not be made unless the potential for product drift can be controlled.
- New injection technology may allow for systemic control of certain insect pests with minimal or no impact to human or environmental health. DPR will continue to explore this technology as a potential control in the future for insect pests that may threaten the health of valuable park trees.

### 3. Integrated Pest Management

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#### Disease Control

DPR does not actively control disease pests in trees. However, increased concern for the Pacific Madrone and concern about Dutch Elm disease may require DPR to become more proactive in managing disease pests in significant tree populations. As with insecticides, it is unlikely that DPR will subscribe to general foliar applications of fungicides or similar pesticide products to control disease pests in trees. The following are control measures that can be performed:

- Trees that are susceptible to particular disease pathogens may be removed from the landscape and replaced with resistant varieties.
- When possible, parts of trees affected by disease should be pruned out and properly disposed to stop the spread of disease within the tree and to adjacent trees.
- An appropriate fungicide may be applied to control a specific disease pathogen in very selected situations. These cases include specimen quality trees in special gardens or in high-visibility park locations where the presence of the disease threatens the life of the tree. In these situations, general foliar applications will not be made unless the potential for product drift can be controlled.
- New “injection” technology may allow for systemic control of certain disease in trees pests with minimal or no impact to human or environmental health. DPR will continue to explore this technology as a potential control for disease pests that may threaten valuable trees in City parks.

#### Physical Damage to Trees



Physical damage to trees can be a major factor in overall loss of trees. This damage most often occurs in one of two ways. One is when trees are repeatedly struck by mowing equipment. A second form of injury is by string trimmers, which can damage bark leading ultimately to tree loss. Many trees are also lost to lack of appropriate care during construction projects within existing parks.

- Removing turf from around the tree base to create tree mulch rings 3 to 4 feet in diameter can substantially reduce damage caused by mowers and trimmers. With tree mulch rings, a mower or trimmer never has to come close enough to the tree to cause damage. The tree mulch ring will need to be kept free of grass and weeds (see the following section, "Turf").
- Following the BMPs in Section 1, Construction Site Management, substantially reduces or eliminates damage from construction activities.
- All pruning for tree health reasons and for hazard reduction will be done in conformance with ISA standards.

## Turf

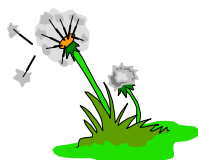
The City of Seattle Park system maintains a wide variety of turf types. These include park lawn areas (both formal and informal), athletic fields, golf courses, meadow areas and other turf types. In total, the park system has over 1,400 acres of turf including 192 acres of athletic fields and 460 acres of golf course turf with the remainder in park lawn area. Each of these turf types has different pest management challenges.

### Pest Tolerance Thresholds

- Weed, insect, and disease pests are typically tolerated in general park lawn areas.
- Turf pests in highly maintained turf such as athletic fields, bathing beaches and other high-visibility/high-use areas are generally controlled through good turf cultural practices.
- Only in rare situations are pesticides applied to park turf areas.
- Because of the unique conditions present on golf courses, a variety of pest control measures are used, including mechanical, cultural and chemical.

### BMPs: Pest Management Control Strategies

#### Broadleaf Weeds



Weeds in turf are generally tolerated with the exception of golf course turf and a few high-visibility park turf areas. When control is necessary, the primary method is through the following cultural practices:

- careful monitoring of watering practices
- fertilization
- aeration
- top-dressing
- over-seeding.

By performing these cultural practices, park turf is made healthier and better able to compete with various broadleaf weeds.

Chemical weed control will be used only as a last resort for controlling particularly difficult weeds in high-visibility turf areas.

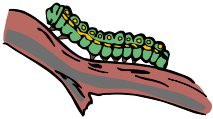
- In these rare situations the least toxic, least residual pesticide will be used for spot treatments.
- General broadcast treatments will be avoided.

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- Timing of such applications will be made to avoid contact with the public to the extent possible.
- Posting of the site that has been treated will be done as legally required.

Maintenance for the City's golf courses generally does have to control for broadleaf weeds. This control is done through cultural practices and spot application of carefully selected herbicides.



#### Insects

The only real insect pest of significance for turf in the Seattle area is the European Crane Fly. While it can be quite damaging to turf areas, the crane fly is not controlled for prophylactically in City of Seattle parks.

- Chemical control is used only in the rarest of circumstances to turf of very high visibility and value such as golf course turf and very selected high-visibility/high-use park turf areas.
- Any chemical applications will be spot treatments directed specifically at the turf areas containing the pest.

#### Disease

**General Park Turf.** Disease in general park turf is typically tolerated and not actively controlled.

- In high-use/high-visibility park turf areas, disease will be controlled to a considerable degree by performing sound cultural practices.
- Pesticides are not used to control disease in park turf areas.

**Golf Course Turf.** Because turf disease can be a significant problem on golf courses, it must be controlled to preserve the function of this asset. Golf course turf, particularly greens and tees, must perform under extreme conditions of maintenance and use. These conditions make golf course turf more susceptible to disease than general park turf.

- Golf turf disease is controlled through good cultural practice to the extent possible.
- Certain diseases are controlled through the application of an appropriate fungicide.
- When used, fungicides are applied to the diseased turf only, such as a green.
- The least toxic and still effective products are used.



- The fungicide used will be rotated yearly to reduce the chance of the turf disease developing a resistance to the chemical control.



### Grass Trimming Abatement

The control of grass growing along fence lines and around trees, bollards, posts and other landscape features is a regular maintenance activity that helps preserve the asset by allowing large riding lawn mowers to steer clear of objects. This is especially important around trees where impact from mower damage can easily lead to tree loss. At the same time, keeping this grass controlled allows DPR to present parks that appear clean and well kept. This grooming affects how the public uses our facilities. Well-maintained parks are subject to less vandalism and related misuse. The following are BMPs for grass trimming:

- **String trimmers or push mowers.** The grass is trimmed using gas-powered string trimmers or push-type lawn mowers. This labor-intensive practice is costly and produces noise and air pollution.
- **Herbicide.** This work is also often performed through the annual (or less frequent) application of the herbicide Roundup Pro®. This product is sometimes used in conjunction with Surflan® to provide ongoing pre-emergent control of weed and grass seed not yet germinated in tree mulch rings and similar areas.
- **Concrete mow strips.** As resources are available, it is sometimes possible to provide a “mow strip” of concrete or a similar low maintenance product around some landscape features to eliminate the need for grass trimming. This control option is costly and doesn’t work in all situations.

## Natural Areas

Natural areas are City-owned property with critical environmental resources. Natural areas shelter native ecosystems and wildlife habitat. These sensitive areas and habitats include nearly all classifications in the City’s *Regulations for Environmentally Critical Areas*. Natural areas fall into a number of categories, including steep slopes and slide prone areas. For the purposes of this BMP manual, these resource assets are divided into three major groups:

- Wetlands, riparian corridors, shorelines and aquatic habitats
- Forests
- Meadows

There are pest management issues and preferred control strategies associated with each of these habitats.

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### Pest Tolerance Thresholds

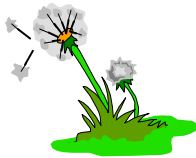
#### For all natural areas:

- Invasive plants are generally not tolerated. Invasive plants will be controlled in conjunction with ecosystem restoration efforts in these environments as resources permit and where control can be practically achieved.
- Noxious weeds will not be tolerated and will be controlled when found in conformance with State of Washington mandate.
- Weeds are generally found in these environments and many will be tolerated.
- Only insect pests that pose a risk to the public (such as hornets) or to the resource (such as gypsy moth) will be controlled.
- Plant diseases will generally be tolerated unless a specific control can be employed that will be effective in ensuring the health of particularly valuable assets or if they pose a threat to other plant populations outside of the natural area.

### BMPs: Pest Management Control Strategies

#### Weed Control

An overriding principle of IPM is the maintenance of healthy plant communities. That means weed control of the following types:



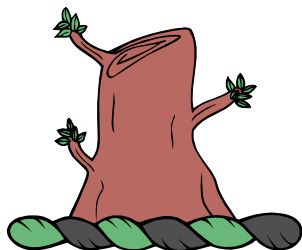
- **Timed mowing.** Carefully timed mowing before seed set can effectively reduce weed seed sources. Frequent mowing can eliminate blackberry and other woody species.
- **Mulching.** Mulching around the base of plantings is widely accepted as a horticultural practice for soil fertility and weed control. In most instances, composted wood chips or onsite recycle leaf litter are adequate materials. Avoid wood chips from diseased trees. Mulch should be between 2 to 3 inches deep for best results.
- **Weed watch during mulching.** Care must be given to not incorporate new weed problems when importing mulch materials.

#### Woody Brush Control

The control of woody brush like blackberries and poison oak is very important in certain park locations. Often these plants are found in transition areas between developed park areas and natural areas. If not controlled, woody brush can easily over take forest-edge environments, eliminating vital habitat opportunities. Control measures for woody brush include the following:



- Manual or mechanical removal using hand tools or gas-powered equipment. Special tools are now available for removing woody brush. In many areas, this can provide effective control.
- Chemical control with Roundup Pro® or Garlon 3A® can be employed when other measures are not possible or have failed. Spot applications are preferred whenever possible although area applications may be employed, especially for poison oak where handling by humans is dangerous. Any area applications will be limited to the area of infestation.



### Stump Re-Sprouting Control

Often there is a need to remove small trees and prevent re-sprouting of a stump. Methods for controlling the re-sprouting of stumps include the following:

- If the location of the stump(s) will allow access by equipment, then they can be mechanically removed providing the location is not within an environmentally critical area.
- Small stumps may be removed manually providing they are not on steep slopes or in other environmentally critical areas.
- The re-sprouting of stumps can also be controlled by painting newly cut stump surfaces with Roundup Pro® (for some species) or Garlon 3A®. Care will be taken to limit the application of selected herbicide to the stump surface only.



### Invasive Plant Control

Invasive plants have taken over many of the City's forested areas and have radically and negatively changed pre-existing ecosystems. Attaining long-term control of invasive plants is essential to the recovery and preservation of Seattle's natural ecosystems. Invasive plant control shall follow the guidelines established by *King County Noxious Weed Boards*. Except in the case of Class A weeds, the goal is suppression of weed populations to below threshold (damage causing) levels. Eradication of certain ecological weeds (blackberry or ivy) in all of the City's natural areas is neither feasible nor cost-effective. However, controlling spread of the problem and eradicating it in certain priority locations are DPR goals. Control methods include:

- Use *extent of removal* and *type of habitat* to determine the pest control method.
- Large areas that are totally infested can be mowed. Areas that are interspersed with invasive pests require more selective procedures such as manual removal.

### 3. Integrated Pest Management

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- Heavy equipment or manual removal can be used on firm soils. On either steep or saturated soil, use techniques that will minimize site or slope disturbance.
- Where mechanical or manual removal is neither possible nor practical but control is essential, careful and selective use of an approved herbicide is permitted. The list of approved herbicides is limited to Roundup Pro®, Rodeo® or Garlon 3A®. The use of these products shall conform to the practices listed under “Herbicides” above.
- Re-establishing a new native planting regime as quickly as possible following the removal of invasive plants is critical to successful forest restoration. These new plantings will require care for several years to guarantee establishment.
- Preserve established native plants when possible rather than reestablishing new plants after the clearing of invasives.



#### **Herbicide Use**

The use of herbicides in any natural environment must be carefully considered. Herbicides will be used for weed control in natural areas only when other control measures have been tried and have failed or when past practice strongly indicates that control of the weed pest can only be achieved through the use of a herbicide. Herbicide use practices shall be as follows:

- Cut and stem treatment (daubing or painting) is the preferred choice for natural area management.
- Certain invasive plants are difficult to treat and control in their mature form. If possible, remove existing growth manually or mechanically. Wait for new growth to become established. Then treat with the appropriate and approved herbicide.
- Herbicides approved for use in natural areas are limited to Roundup Pro®, Rodeo® (near aquatic habitats) or Garlon 3A®.

#### **Exotic Insects**

Insects like the European and Asian Gypsy moth and the Asian Long Horned Beetle can potentially devastate Seattle’s urban forest. City of Seattle departments will cooperate with state and federal agencies in their monitoring and control programs to prevent the introduction of these pests.

#### **Nuisance Wildlife**

Mountain beavers, beavers, opossums, raccoons, waterfowl and other species can be destructive to natural areas when their activities are excessive. If control of

wildlife is needed, DPR will work with the most appropriate city (Animal Control) or state (Department of Wildlife) agency to gain control.

### **Root Rots**

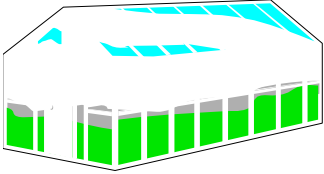
Even native forests can have serious disease problems. Root rots are the most serious problem, leading often to the death of significant trees. Several strategies help control root rot in forests:

- inoculate with mycorrhizae
- remove infected wood
- plant resistant varieties
- treat hemlock stumps with borax
- do not change site conditions on mature trees.

## 4. Greenhouse Operations

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### 4.1 Purpose



The purpose of this section is to identify and define the best management practices for greenhouse operations. The Department of Parks and Recreation (DPR) greenhouses produce more than 200,000 plants annually—including its own annual and perennial flowering plants and those grown for other City departments. Any serious management errors could lead to the loss of entire crops and the additional expense of replacing them.

### 4.2 Definitions

**greenhouse:** a house of glass construction used for the propagation, growing, and care of plants.

**conservatory:** a facility similar in construction to a greenhouse and used for the display of unique and exotic plants that typically cannot be grown outdoors in the Pacific Northwest.

### 4.3 Background

The City of Seattle operates and maintains four greenhouses located in four separate facilities:

- **Jefferson Greenhouse.** This facility, located at 1600 S. Dakota Street, houses the production of annuals, perennials, natives, ornamentals and holiday crops for DPR as well as other City agencies.
- **Volunteer Park Greenhouse.** At this facility, DPR supports a unique and valuable collection of exotics and tropical plants used in Volunteer Park Conservatory. Thousands of plants for seasonal color displays in the Conservatory are also produced here.
- **Volunteer Park Conservatory.** In this 7,000-square-foot facility are displayed and maintained a wide variety of exotics, tropical plants, and specialty crops for general viewing. The conservatory is noted for its orchid collection.
- **Woodland Park Greenhouses.** This complex houses tropical plants. Here, DPR grows plants for the Woodland Park Zoo tropical rainforest and other indoor exhibits.



## 4. Greenhouse Operations

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These facilities are used to propagate plants for introduction into park landscapes, Volunteer Park Conservatory, and Woodland Park Zoo. These plants are grown as large production crops with extreme care taken to ensure high-quality, healthy plants.

DPR grows its own annual and perennial flowering plants and through a contract arrangement does the same for other City departments. As with the propagation of woody landscape plants, it is most cost effective for DPR to grow these plants than it is to purchase them from vendors. In-house propagation also provides significant flexibility in the types and size of plant species that can be grown.

### 4.4 Special Conditions



#### Climate Control Systems

- All DPR greenhouse facilities are operated by computers that control environmental conditions inside the houses.
- Ventilation, heating, misting systems, lighting, weather stations and sensors all contribute to maintain diverse conditions for optimal crop production and holding capabilities.
- All DPR greenhouses use GEM III software (Greenhouse Environmental Manager) designed by Q-Com of California.
- Greenhouses are all programmed separately depending on the conditions needed.
- Periodically, software has to be updated to keep current with new technology.



#### Fertilizer Injector Systems

The greenhouses are equipped with an injector system that fertilizes the plant crops through the irrigation system.

## 4. Greenhouse Operations

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### 4.5 Maintenance Practices

The following describes specific routine practices for greenhouse maintenance and production.

#### Building Maintenance

- Perform routine upkeep of all greenhouses, potting sheds, cold frames, lathhouses and storage sheds for safe day-to-day operations.
- Keep all public areas (Conservatory) clean and safe for workers and citizens visiting these areas.
- Clean and pressure wash all greenhouse floors and other work surfaces on a bi-monthly (or as-needed) basis.
- Maintain all equipment used in the greenhouses in good working order.
- Keep tools and supplies well organized and properly stored.
- Identify and direct annually scheduled preventive maintenance for the upkeep of the greenhouse and related structures and equipment.
- Winterize all systems before October 20<sup>th</sup>.

#### Production

##### Planning

- A calendar year plan shall be made for producing, distributing or rotating plants and for purchasing supplies.
- Accurate planning records shall be maintained and reviewed annually.

##### Propagation

- Methods of propagation shall include, but not be limited to, seeds and vegetative cuttings, divisions, plugs.
- Horticultural principles shall be specific to diverse crops whether exotic or native.
- Native and ornamental propagation is a cooperative effort between the Jefferson Greenhouse and the Atlantic Nursery.

## 4. Greenhouse Operations

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### 4.6 Cultural Care

The following are guidelines for preventing typical problems that can occur in greenhouses used as production facilities.

- Routinely groom crops. Remove algae from floors with pressure washer to prevent slipping, clean benches and pots to reduce disease potential and as a safety factor for slipping.
- Thoroughly water plants as needed. Clear watering is done intermittently to leach salt buildup in soil – usually every 6-7 days.
- Fertilize crops as needed with a fertilizer appropriate to the crop.
- Fertilize with the injector system every time watering is done unless the intent is to leach salt buildup.
- Provide shade for those plants that need it.
- Bring plants indoors to protect them during winter. Close cold frames in freezing weather to protect crops. Use frost cover fabric on crops that are in the cold frames during below-freezing temperatures.

### 4.7 IPM

Greenhouses are a production operation dealing with large numbers of plants in a closed, non-public environment. Many of the crops grown or nurtured are exotic, unique and extremely valuable. Because of these factors, the tolerance threshold for many pest problems is much less in the greenhouse or conservatory environment than it is in general park landscapes. While the greenhouse program received a King County Enviro-Star Award in 1998 for progressive IPM implementation, these facilities are nevertheless required to maintain and often use a broader palette of pesticide products.

#### **Pest Tolerance Thresholds**

Because City greenhouses produce great numbers of plants in support of many DPR programs, pest tolerance thresholds are very low. The same is true for the Volunteer Park Conservatory, where much of the plant collection is very rare and of great value.

- Weeds are not tolerated in either City greenhouses or its Conservatory.
- Insect pests that threaten the health of plant collections or production crops are not tolerated in the greenhouses or conservatory.

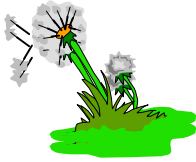
## 4. Greenhouse Operations

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- Disease pests that threaten the health of plant collections or production crops are not tolerated in the greenhouses or Conservatory.

### **BMPs: Pest Management Control Strategies**

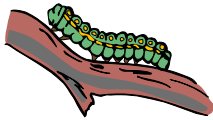
#### **Weed Control**



The following are management techniques for weed control in greenhouses or the Conservatory.

- Greenhouse operating areas and containers and conservatory display spaces are kept free of weeds through hand/manual weeding.
- Weeds are controlled in exterior spaces, building perimeters, shade houses, cold frames and related areas either by hand or mechanically with push type mowers and string trimmers or suppressed with landscape fabrics.
- Some exterior areas receive pesticide treatments with Roundup Pro® or Surflan® for weed control.

#### **Insect Control**



Insect pests are routinely monitored by visual inspection or use of “sticky traps.” Populations are kept below injury thresholds by:

- Proper cultural practices including regular irrigating and fertilizing.
- Removal of insects by hand or washing them off the affected parts of the plants.
- Biological controls using beneficial insects and other organisms that attack pest insects. Periodic releases of beneficial insects help to suppress and reduce the need for chemical control.
- Spot treatments of the least toxic, yet effective, insecticide directed at specific plant parts for specific pest control.

#### **Disease Control**

Disease pathogens are controlled by the following methods:



- Provide good sanitation techniques including regular removal of plant debris and keeping tools and work areas clean.
- Provide proper spacing between plants for good air circulation.
- Select disease resistant plants.

## 4. Greenhouse Operations

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- Keep diseased plants away from healthy crops.
- Apply the least toxic, but effective, pesticide product to control specific disease pathogen on a specific plant or crop.

### 4.8 Training



#### Basic Greenhouse Training

People who are inexperienced in greenhouse operations but who are expected to perform a wide range of skilled tasks for DPR must have a reasonable period of hands-on training. This includes new employees, seasonal employees, or volunteers. Experienced senior staff will provide the training. All new or seasonal employees and volunteers must have this training before they will be given full responsibility for work in DPR greenhouses. The training should be given in full-day increments, be as thorough as possible, and be specific to the location and type of work involved.

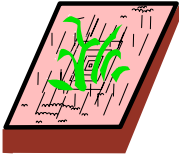
#### Advanced Skills Training

Employees should be encouraged to pursue work related training to continue skill development.

## 5. Nursery Operations

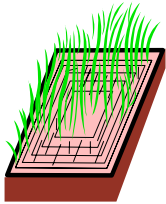
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### 5.1 Purpose



The Department of Park and Recreation (DPR) Atlantic City Nursery produces about 20,000 plants per year. The nursery provides a cost-effective way for the City to meet landscape plant replacement needs throughout its park system. Strict operational practices are followed to produce high quality and healthy plants in DPR nurseries. This section identifies and defines these best management practices for nursery operation.

### 5.2 Definitions



**clean green:** refers to various plant debris such as leaves, pruned limbs, etc. that has not been contaminated with garbage and is suitable for recycling and composting.

**nursery:** a facility for the propagation and growing of plants for use on developed and undeveloped park property.

**poly-house or shade house:** terms for greenhouse-type structure that provides a minimal level of cold weather or sun protection required by nursery crops.

**senior gardening staff:** DPR staff person responsible for managing the nursery. Senior gardeners are "journey-level" positions, possessing a broad range of horticultural knowledge and skills.

### 5.3 Background

#### Atlantic City Nursery

The DPR operates Atlantic City Nursery at 5513 S. Cloverdale Street. The nursery occupies roughly 6 acres and has been in continuous operation for more



than 30 years. An increasing number of the plants produced by the nursery are Pacific Northwest natives grown for use in forest or landscape restoration projects. The Atlantic City Nursery also produces ornamentals, groundcovers, vines, perennials, shrubs, and trees. The plants are grown to support various needs throughout the park system from small in-house planting projects to large capital improvement projects.

An increasing number of these plants are Pacific Northwest native species grown for use

in landscape restoration projects. Increased native plant production ensures the variety of plants needed in the sizes required. Although the nursery does not supply all landscape plants DPR uses, it does provide most of them.

The nursery works very closely with the greenhouse operation at Jefferson Park. Most plants are propagated in the DPR's four greenhouses and later moved to the nursery when they are of sufficient size. To meet the needs of capital projects, the nursery is growing an ever-increasing number of plants, creating space and resource problems with the current operation. In the future, the nursery will require facility modification and upgrading.

The following are features of the Atlantic City Nursery:

- office and storage building
- growing fields and frames
- holding and healing-in area
- container yards
- poly- and shade houses
- propagation areas: cold frames, seed beds, poly-house.



### Basic Operating Plan

- Most of the nursery operation is containerized. Plants are grown in containers to various sizes for eventual planting in parks. A containerized operation is both cleaner and less labor intensive than field growing, particularly when moving plants out of the nursery.
- Plants are field grown to meet specific needs such as large specimen trees.
- A computer-based inventory will record current inventory, incoming requests and plant materials that are already obligated to a project.
- Computer connection to the City of Seattle network will provide immediate access to current plant inventory. It will allow gardening, design, and project management staff easy access to ordering plants or to communicating plant propagation needs.

## 5. Nursery Operations

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### 5.3 Plant Selection

- The DPR nursery program is not designed to carry a large number of plants in its inventory. Surplus plants are not cost effective given the care required to maintain a large inventory.
- The types and quantities of plants selected for propagation are generally determined through requests from other DPR staff or to meet particular requirements of various capital projects.



- Both ornamental and native plants are propagated in anticipation of annual needs based on history.
- Some plants are grown as test subjects for possible introduction into park landscapes.
- Some plants are grown as “stock” and are maintained for propagation.

### 5.4 Maintenance Practices

The following are standard practice for preparing and maintaining plants grown in DPR nursery operations.

#### Site Preparation



- All plant growing areas will have adequate drainage to ensure plants are not sitting in water or saturated soil.
- Field growing soil and imported potting soil will be tested as needed to determine the need for amendments/nutrients.
- The container soil mix shall be compost (20%), peat (15%), pumice (25%) and fine decomposed bark (40%) with 1 lb. calcium nitrate added per cubic yard.
- Soil for field growing shall be a sandy loam with not more than 30% organic material in the form of equal parts of compost and bark (Note: bark in this

case is fir or hemlock free of wood waste products. Cedar bark or chipping debris shall not be used).

- Crop rotation practices will be employed in field growing areas.
- A cover crop (mowable grass) will be used in field growing areas to reduce erosion potential.

### Site Maintenance

- Noxious weeds will be controlled or removed from the site during preparation (see Section 5.6, IPM, below).
- Roads and pathways will be maintained on an annual basis to ensure accessibility.
- While the nursery supports various community programs, the general public shall not have access to the nursery grounds except and unless a pre-approved department staff person is also present.

## 5.5 Cultural Care

The following are preventive maintenance techniques DPR uses to ensure the quality of its nursery grown plants.

- Plants will be pruned per American Association of Nurserymen standards (or DPR-approved equivalent) as needed to ensure good health and structure.
- Field grown plants will be root pruned annually to ensure ease of transplanting and successful replanting, to prevent girdling and to encourage feeder root growth.
- All plants will be spaced to allow for optimal growth, especially in field growing areas.
- Crop rotation practices will be employed in field growing areas.
- Containerized plants will be re-potted as needed to prevent encircling roots and to allow them to grow into their desired natural form without girdling.
- All plants will be watered as needed. The primary method of irrigation is the existing overhead system. This system works well for field growing areas but is modified as needed for watering containerized plants.
- City water used for plant irrigation purposes will be used efficiently.
  - Plants will be grouped by size and water needs.

## 5. Nursery Operations

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- Watering will be done on an as-needed basis.
- The most efficient system for watering individual planted areas will be used.
- Avoid watering nursery areas that aren't currently holding plants.
- The nursery will support recycling.
  - Compost will be used whenever possible.
  - Growing containers will be reused (following cleaning).
  - Greenhouse soil will be recycled for nursery use.
  - Plant debris will be sent to "clean-green."
  - Used soil from containers will be reused onsite whenever possible.
- Plants shall be fertilized as needed using slow-release types of fertilizers. The type and formulation of fertilizer used typically is Osmocote standard slow-release formulation, 18-6-12.
- Plants requiring shade conditions will be held in the shade houses.
- Plant holding areas will be used for plants that are in transition. While in holding, plants shall be mulched, staked as needed, watered, and provided with shade protection if required.
- Winter protection shall be provided for plants as needed through the use of existing greenhouses or "frost blankets." Smaller, more tender plants will have priority for winter protection.

### 5.6 IPM

Control of pests in the nursery environment is very important because many plants may be affected.

#### **Pest Tolerance Thresholds**

- Pests that threaten the health of the nursery crops will not be tolerated and will be controlled.

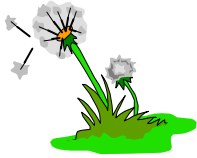
#### **BMPs: Pest Management Control Strategies**

##### **Surface and Groundwater Protection**

- General site runoff is controlled through biofiltration.



- Select the least toxic and most non-leaching chemical products only when necessary. Precisely follow all label instructions.



### Weed Control

- Most weed control at the nursery is accomplished through hand weeding, mulching and use of landscape fabrics
- When other controls have failed, Roundup Pro® herbicide is used for spot control of weeds.



### Disease Control

- Select disease-resistant plant varieties.
- Monitor plant crops for disease outbreaks.
- Practice good cultural practices including watering, fertilizing, pruning and maintaining good air circulation.
- Reduce the potential for transfer of disease through good sanitation techniques. These practices include keeping growing areas, tools and containers clean and removing plant litter and debris in a timely manner.



### Biological Pest Controls

- Habitat for natural insect pest predators will be encouraged as an environmentally sound means to reduce populations of insect pests.

## 5.7 Training



The DPR will develop a basic training program for staff assigned to work in the nursery. This training will also be made available to other DPR staff to broaden their horticultural skill base.

### 6.1 Purpose



Landscape plant beds are often the focal point of a park. They provide color, texture, space definition, fragrance, wildlife habitat and other benefits enjoyed by park users. In the Pacific Northwest, climactic conditions favor growing a wide variety of ornamental landscape plants and a rich palette of Northwest native plants. These environmental conditions have allowed planners and designers of the Seattle Park system to create a landscape plant collection of real beauty worth millions of dollars and acknowledged as one of the finest in the country. Careful management of these assets is required to continue the heritage and maintain the value of this substantial plant collection.

### 6.2 Definition

**plant beds:** Plant beds are non-turf, planted areas that include woody plant material such as shrubs and trees and ground covers. Plant beds also include floral color displays, containing herbaceous plants such as perennials, annuals and bulbs.

**fertilizing:** The use of organic or inorganic materials to adjust fertility levels in the soil.

**edging:** The control by manual or chemical means of plant growth, both to lawn area surrounding the bed, and plant material in the beds.

**irrigation:** The supply of water to plantings, either through automatic irrigation systems or manual systems, which can include soaker hoses.

**weed control:** The control of undesirable plants species.

**manual or mechanical control:** The use of hand and power tools to remove unwanted vegetation.

**chemical control:** The use of herbicides, both pre-and post-emergent.

**biological control:** The use of biological agents such as insects or diseases to control weeds.

**insect control:** The suppression or eradication of harmful insects in the landscape.

**disease control:** The maintenance of healthy plants accomplished by good cultural practices.

## 6.3 Background

Level of visibility and site use dictate maintenance standards for plant beds. Even within the same park, maintenance techniques can differ for formal plantings and high-traffic areas as opposed to remote areas that may remain informal and natural. For that reason, plant bed BMPs are tailored to the specific requirements of plant material and site goals. At a formal site, the desired result may be to promote prolonged bloom in floral displays. For the remote park and its natural area, the goal may be to accommodate public use patterns and protect nesting wildlife.

Plant beds can be divided into six categories according to level of visibility and usage:

1. **Floral Beds** are very visible and have a high standard of maintenance
2. **High-Visibility/Public Facility Landscapes** have highest visibility and a high standard of maintenance
3. **General Landscape Bed Areas** have moderate visibility and standard of maintenance
4. **Special Garden/Zoo Exhibits** have highest visibility and the highest standard of maintenance.
5. **Newly-established Landscapes** will have a very high standard of maintenance through the plant establishment period (1-5 years).
6. **Low-Visibility Bed Areas** that require moderate to high maintenance may be targets for redesign or removal.

## 6.4 Design

The following are design considerations for plant beds within City of Seattle parks.

### Existing Site/Environmental Conditions

Environmental considerations are taken into account when planning a new planting or renovating an existing one. The following design factors must be weighed:

- **Current Landscape Condition.** The condition of current plant material is a good indicator of existing cultural conditions. Compaction, low nutrients, and types of pest populations determine renovation and plant selection options. This is particularly true of soil-borne pathogens such as phytophthora root rot. Selecting resistant plant materials is a must.

## 6. Plant Beds

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- **Soil Type and Condition.** Soil may require amendment to improve drainage or water-holding capacity. Heavy clay or very sandy soils may be improved if desired, but appropriate plant selection is vital to the success of the planting.
- **Drainage.** Irrigation and drainage conditions must be assessed and any improvements included in the design process.
- **Cultural Conditions.** Cultural conditions such as exposure to sunlight and reflected light and heat, wind, and rainfall apply to plant selection and irrigation installation.
- **Safety.** Safety issues include falling branches, plant growth that blocks pathways, visibility through shrub beds, and rerouting pedestrian traffic to sidewalks.
- **Flowers.** In floral displays, the maintenance budget for the display must be taken into consideration when selecting plant material. Some annuals and perennials require more grooming than time constraints allow, and should only be used where they will receive adequate care.
- **Species Diversity.** Species diversity offers a longer season of interest. Monocultures can be more susceptible to total failure in case of insect or disease problems.

### Site Preparation

Preparing the site is most important to the long-term success of a landscape. Making the necessary cultural improvements before planting saves time and money. The following are BMPs for site preparation:

- **Existing Weeds.** To prepare a site for landscaping or renovation, existing weeds and undesirable plant materials should be removed as thoroughly as possible. Weed populations (especially difficult-to-control weeds such as horsetail and morning glory and quackgrass) affect planting plans. In a primary bed location, they should be eradicated before installation of new landscapes. If mechanical eradication is not practical, an appropriate chemical control may be used. (See Section 6.7, IPM).
- **Overgrown Plants.** Plant material that is too large for the space should be replaced with appropriately sized species.
- **Diseased Plants.** Disease and insect-resistant material should be selected, and used where the culture will promote healthy growth. In an existing planting to be renovated, diseased plants may need to be removed.

- **Soil.** Soil amendments as required should be added to and incorporated into an entire planting area. Avoid tilling saturated soils, which can damage tilth. See the *Seattle Department of Parks and Recreation Standard Specification "Soil Preparation"* (#02930.32) in the yellow pages at the end of this section.
- **Water.** Irrigation and drainage systems should be installed as needed.
- **Landscape Features.** Install retaining walls and other landscape features.
- **Rocks and Debris.** Excessive rocks and debris must be removed. Rake area to establish finish grade.
- **Fertilizers.** A soil test indicates fertility levels in the soil. Fertilizer, if required, should be applied to site and incorporated into soil. It helps to know if amendments include uncomposted woody material, which will require nitrogen.
- **Annuals.** Annual flowerbeds must be spaded or tilled at planting time. Amendments such as compost, GroCo/SteerCo, sand, or perlite can be added to adjust drainage. In containers, the addition of hydrating gel can enable the use of plant material that might not otherwise be appropriate to water requirements.

## 6.5 Maintenance Practices

Routine maintenance for plant beds ranges from planting and edging to irrigation.

### Planting

The following guidelines for proper installation of plant material ensure good establishment and healthy growth.

- **Fertilizer.** Fertilizer, if needed, must be incorporated into soil before adding plants. It is best to wait until plants are established before adding chemical fertilizers. See the *Seattle Department of Parks and Recreation Standard Specification "Plant Fertilizer"* (#02930.28) in the yellow pages at the end of this section.
- **Depth.** Plants must be placed at proper depth, taking into consideration room needed for mulching. See *Seattle Department of Parks and Recreation Standard Specifications "Bark Mulch"* (#0290.31) and *"Fertile Mulch"* (#0290.35) in the yellow pages at the end this section.
- **Spacing.** Proper spacing with consideration of mature size and spread of plants ensures good establishment. Good air circulation and availability of

## 6. Plant Beds

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sunlight, water and nutrients will reduce weak growth and avoid development of disease. Ground covers and floral plantings should be close enough to provide adequate coverage to compete with weeds, and provide effective display, without being too crowded at maturity. See the *Seattle Department of Parks and Recreation Standard Specifications* "Planting, Trees, Shrubs, and Ground Cover" (#02950.11) in the yellow pages at the end this section.

- **Water.** Water new plantings to settle soil and reduce transplant shock. Ensure adequate moisture levels during the growing season.
- **Mulch.** Mulch at planting time for maximum efficiency. Rake soil smooth to prevent puddling, then select mulch. Avoid smothering small plants. A fine mulch is preferred as it becomes the next season's planting soil.

### Edging

Edging controls—by either manual or chemical means—the plant growth both in the lawn surrounding a bed and plant material in the beds. The main purpose is to maintain a neat edge to the planted area. Proper edging also controls weeds in the bed edge.

- **Informal plantings** can be maintained mechanically or chemically to control turf and weed encroachment onto mulched areas.
- **Formal plantings** can be maintained by hand tools and mechanical means (use of a power edger) and removal of clippings.

### Irrigation

- Site conditions such as soil type and slope, exposure and moisture requirements of plants dictate both frequency and duration of application.
- Weather conditions, such as temperature and rainfall, require monitoring and response. Generally, most plants require at least 1 inch of water per week. Drought tolerant plants, once established, may need less. Floral plantings, particularly in containers, require considerably more.
- Infrequent deep watering is preferable. Avoid creating runoff.
- Shrubs, ground covers and flowers planted in the root zones of large trees need more water to balance the competition from the tree roots.
- Consider pedestrian access, park usage, and available personnel when establishing irrigation schedules.

- Drip systems are useful in plantings sensitive to overhead watering. Avoid disease damage by keeping water off leaves.
- Be sure to begin watering early enough in the spring.
- Visually test and monitor the system regularly.

## 6.6 Cultural Care

The following preventive maintenance materials and techniques ensure a consistent standard of environmental stewardship in City parks and grounds. See the *Seattle Department of Parks and Recreation Standard Specifications* in the yellow pages at the end of this section for more information on mulching and fertilizing plant beds.

### Mulching

Mulching serves to conserve moisture, retain soil, suppress weed growth, moderate soil temperature, reduce compaction, and supply nutrients for plants and soil microbes. It is also aesthetically pleasing, making it desirable for high visibility locations.

- **Materials.** Materials include bark products, compost, wood chips, GroCo/steerCo, grass clippings, leaves, pebbles, nutshells, coffeebeans, etc.
- **Depth of application.** This varies according to type of plant material, but averages 2 to 3 inches. Keep mulch materials away from contact with trunk or crown of plants to avoid stem rot.
- **Edge of beds.** Recess edge of beds to avoid drift of mulch materials onto turf or pavement, where necessary
- **Flower bed.** Flowerbeds should be mulched with a fine material such as steerco or sifted compost, taking care not to smother plant crowns. Generally, mulch in an annual planting is 1 inch deep although a deeper layer of mulch, if possible, will provide better weed suppression.
- **Woodchips.** Uncomposted woodchips can deplete soil nitrogen as they decompose. Use of woodchips may require application of a nitrogen-rich fertilizer.
- **Fallen leaves.** The use of fallen leaves as mulch may be appropriate in some areas. Avoid using diseased or insect-infested material. Leaves will decompose more quickly if they are shredded. It is important to avoid smothering the roots of the desirable plants with too thick a layer. A 2-inch layer is considered best. Compost from plants that are known to be diseased must not be used for mulching purposes.

### Fertilizing

Fertilizing, the use of organic or inorganic compounds, is tailored to specific requirements for plantings:

- **Nutrients.** Nutrient requirements differ according to plant type and the desired performance of a plant. Turf grass and other plants grown for their vegetative growth require more nitrogen than plants grown for flower and seed production. Plants grown for flower and seeds require more phosphorus and potassium. Too much nitrogen can cause excess growth, which will be more susceptible to insect and disease damage.
- **Application Timing.** Timing application to the biological cycle of the plants is important in maintaining optimum growth. Plants just becoming established may require more P and K in the blend to encourage root development. Also, plants benefit most from fertilizer application at the onset of their new growth in the spring. Applications too close to fall may delay dormancy and promote soft growth, which can suffer winter damage.
- **Micronutrients.** Micronutrients are also important for plant health. It is best to test the soil to determine existing levels of these nutrients because an imbalance can harm plants.
- **Soil pH.** The pH of the soil will determine whether to use an acid or base formulation of fertilizer, as well as the need for lime applications. Always test for pH before applying lime.
- **Formula.** Select a formulation that is best for the soil type and time of year. Cold weather slows the activity of soil microbes that make nutrients available to the plants. A slow-release formula is better suited to cold months. Leaching of fertilizers can also be avoided this way.
- **Floral plantings.** Floral plantings can be fertilized at planting time with slow-release fertilizer. Flowers can also be supplemented during growing season with foliar feedings of liquid fertilizer.
- **Compost.** Compost can be applied as a nutrient source. It must be fully decomposed so that nutrients are made available to plants. Most compost has no more than 3% nitrogen, which is slowly released. Its main benefit is that it encourages beneficial soil microbial growth.

### Pruning

The purpose of pruning includes:

- Encouraging and directing new growth and flowering

- Removing spent blooms and foliage
- Removing insect, disease, and weather damage
- Maintaining size and shape
- Maintaining visibility
- Improving safety
- Creating pedestrian and mower access.

The following are BMPs for pruning:

- **Plant Selection.** Use appropriate plant materials that grow to the correct size for the space. Plant selection reduces the need for excessive pruning.
- **Natural Form.** A natural form is most desirable in many park settings.
- **Hedge Pruning.** Hedge pruning requires careful timing for optimum results:
  - First cut should be made as new growth begins to harden off
  - Last hedging should be made no later than mid-August
  - Hedges should be wider at bottom than top
  - Hedge pruning is labor-intensive and is best applied to plants with smaller leaves as they tolerate heavy pruning better.
  - Because the intensity of maintenance required, formally-pruned hedges are not desirable in many park locations.
  - When major pruning is required of prominent neighbors/park users may need to be notified in advance of the work to be done.
- **Timing.** The best timing of pruning for most plant material is following flowering. Workload balancing, however, often dictates dormant season pruning.
- **Growth Habit.** Growth habit of specific plant material will determine optimum pruning method.

## 6.7 IPM




Plant beds are defined as non-turf planted areas that include woody plant material such as shrubs and trees and ground covers. The category also includes floral color displays containing herbaceous plants such as perennials, annuals, and bulbs. The most serious pest management issue in plant beds is weed control. If

## 6. Plant Beds

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not controlled, weeds not only make a plant look unkempt but, more importantly, can out-compete desirable landscape plants resulting in a loss of assets. Tables 1 and 2, respectively, show pest tolerance thresholds and IPM principles that shall be employed in selecting maintenance methods for plant beds.

**Table 1. Pest Tolerance Thresholds for Plant Beds.**

Area	Weeds 	Insects 	Disease 
General Landscape Beds	Some weeds acceptable. Goal is for bed areas to be generally free of weeds for both asset protection and appearance. Weeds will not be allowed to out-compete desirable landscape plants.	Generally tolerated unless particularly valuable plants are actually threatened.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Highly-visible/ Public facility landscapes	Generally not acceptable.	Generally tolerated unless they threaten particularly valuable plants.  Manual removal of obvious pests is encouraged.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Special gardens/ Zoo exhibits	Generally not acceptable.	Generally tolerated but will not be allowed to damage or destroy valuable plants.	Generally tolerated.  Manual and cultural controls preferred.  Chemical controls used only to preserve particularly valuable specimens.
Floral beds	Generally not acceptable.	Generally tolerated.	Disease problems tolerated. If disease persists, landscape will be replaced.
Newly-established landscapes	Weed control is very important to ensure complete establishment of desired plants.	Generally tolerated. Presence of pests may result in host plant being removed and replaced.	Disease problems, if minor, will be tolerated. Presence of disease problems may result in host plant removal and replacement.

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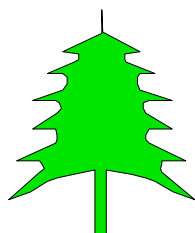
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### 6.8 Training



- The DPR should reinstitute training programs in plant identification and plant bed maintenance for all field staff.
- Training in IPM alternatives for plant bed maintenance will be provided to field staff.

### 7.1 Purpose



Seattle is an urban forest. The health of this forest is a major indicator of the health of our urban ecosystems. In recent years, much attention has been focused on urban forest and tree management issues. Good policies, planning efforts, and planting projects have resulted. This section identifies and defines the best management practices required to ensure a healthy urban forest into the new millennium. This is particularly important since much of the success of salmon recovery efforts will depend on enhancing the quality of our urban watersheds as habitat. These watersheds are an important part of Seattle's urban forest.

### 7.2 Definitions

**derelict tree:** any tree in such poor condition that no reasonable restoration is possible.

**hazard tree:** any tree with a target (should it fall) and a reasonable probability of failure.

### 7.3 Background

The Seattle park system's 6,300 acres contain more than 1,200,000 million trees, many of enormous value. Included within this acreage are more than 8 miles of urban creeks draining 760 acres of urban watershed. Trees and forests are long-term investments the Department of Parks and Recreation (DPR) manages in locations that range from open turf and shrub beds, to streets and boulevards to trails. Park trees, including those in natural areas, clean the air, reduce urban storm runoff, modify temperatures, and provide wildlife habitat and other benefits to citizens and park users. Aesthetically, trees lend form and structure to a park setting. The following table shows the classifications of landscapes and differing objectives and maintenance rationales for tree care:

Classification	Practice
Formal park areas	<ul style="list-style-type: none"> <li>• Require more frequent maintenance than those in natural areas</li> <li>• Create risk because of greater likelihood of tree/people interaction</li> <li>• Suffer a greater incidence of mechanical injury</li> <li>• Demand greater restrictions on design considerations</li> </ul>
Informal (natural) areas	<ul style="list-style-type: none"> <li>• Get grouped together as part of a forest, rather than being a single tree.</li> <li>• Experience greater impacts from competing invasive, exotic plant species, like English ivy and Himalayan blackberry.</li> <li>• Include trees deep within the woods, those in natural or created openings, and those on the forested edge.</li> <li>• Many trees in natural areas abut private property and therefore have a greater risk potential.</li> </ul>

Classification	Practice
Streets/Boulevards	<ul style="list-style-type: none"> <li>• require greater frequency of maintenance than in parks and natural areas because of proximity to people and property and harsh growing conditions.</li> <li>• more likely to suffer from restricted root space, construction damage, mechanical injury, and other related people pressures.</li> <li>• management directly impacts adjacent property owners</li> </ul>

## 7.4 Design

The following design considerations enhance both the aesthetic and ecological value of trees in City parks and grounds.

### Selection

Selecting trees that adapt well to their site and fulfill their landscape function is extremely important to the success and maintenance of a planting. The quality of young plants is also crucial. A plant species should be selected on the basis of its functional uses, its adaptation to the site, and the amount of care it will require.

### Landscape Functions

1. Architectural features: privacy, view enhancement, and space articulation
2. Engineering: reduce glare, direct traffic, filter air, reduce soil erosion, and attenuate noise
3. Climatic influences: transpirational cooling; interception of solar radiation, reflection, and reradiation; and modification of rain, fog and snow deposition
4. Aesthetic uses: form, color, and texture.

### Site Adaptation

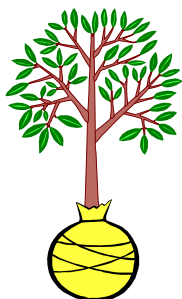
*It is important to plant the right tree in the right place.* The intended landscape use and nature of a site should be considered when selecting for growth habit and ultimate size. Mature size is an important consideration. The tree should not outgrow its allotted space given such constraints as vistas and power lines. The following table shows how to select the right tree:

### Tree Selection Factors

Feature	Benefit
Rate of Growth	Fast-growing trees tolerate difficult sites and neglected trees are usually weak-wooded and subject to limb breakage; and generally are shorter lived.
Wood Strength	Branch structure and wood strength are closely allied. Example: Conifer branches shed snow easily, thus compensating for weak wood. Cottonwood trees are notorious for shedding branches in summer for no apparent reason.
Rooting	Function provides anchorage, nutrients and water. Shallow soils, soils with differing textural strata, rainfall and irrigation can contribute to shallow rooting. Species with invasive roots are problems for sewer and drain lines. Surface rooted trees may sucker heavily, raise pavement.
Plant Features	<ul style="list-style-type: none"> <li>• <b>Leaves:</b> Color, size, persistence</li> <li>• <b>Thorns and prickly foliage:</b> Enhanced security vs. maintenance problems</li> <li>• <b>Flowers and fruit:</b> Aesthetic consideration, wildlife habitat. Potentially increased maintenance.</li> </ul>
Climatic Adaptation	<ul style="list-style-type: none"> <li>• Plant hardiness and local minimum temperatures</li> <li>• Moisture – natural or irrigated</li> <li>• Light – reflect or allow for winter heating</li> <li>• Wind – deflect or channel wind patterns</li> </ul>
Soils	Poor soils can cause failure of planting. Amendment not desirable or feasible. Match plant to soil condition.
Air pollution	Choose trees with appropriate tolerance level.
Pest resistance	Resistant plant material will reduce maintenance
Native Plants	Native or indigenous plants may not perform as well as exotic or non-native species. Most urban landscape sites are no longer “native.” Soils, microclimates and water regimes have changed.
Selecting Quality Stock	Selection of quality planting stock is as important to success as selection of proper species, planting and maintenance. Root and shoot quality can determine not only performance but also survival.
Root defects	Kink roots, girdling (circling roots) can eventually “choke” a tree.
Top & Trunk Characteristics	<ul style="list-style-type: none"> <li>• Height-to-Caliper ratio (see ANSI Z60.1 specs.)</li> <li>• Crown configuration</li> <li>• Branching pattern</li> </ul>

## 7.5 Maintenance Practice

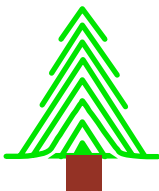
The following are BMPs for routine maintenance of trees in City landscapes.



### Planting

- Ideal planting hole is 3 times the diameter of the root spread or root ball.
- Minimum planting hole is 12 inches wider than root spread or root ball.
- The hole shall be no deeper than the ball and the ball shall sit firmly on the undisturbed subsoil.
- Native soil shall be used to backfill the planting hole except in situations where the existing soil is contaminated or filled with rubble or pure clay.
- Trees shall not be fertilized at the time of planting.
- Balled-and-burlapped trees shall be placed in the hole and plumbed vertically. All rope shall be removed from around the trunk of the tree and the top 1/3 of the burlap shall be folded back down into the hole. Whenever possible, remove the top 1/3 of burlap by cutting it away with a sharp knife. Trees in wire baskets shall have the top 1/3 of the basket removed, using bolt cutters, to expose the top 12 to 18 inches of the ball.
- Do not remove any B&B packaging material until the tree is placed in the hole and securely plumbed into its final position.
- Backfill soil in lifts of 4 to 6 inches at a time with compaction of each layer. Do not compact muddy backfill. Water thoroughly after backfilling to settle the soil, eliminate air pockets and re-wet the root system.
- If project scope allows, watering soil rather than compacting is preferred. Backfill ½ the soil in the tree pit and thoroughly drench with water to settle. Complete backfilling and then thoroughly drench with water again. This method is preferred for removing air pockets and settling soil, but can be impractical on big jobs or jobs using volunteers.
- Trees planted in sandy or loamy soils should have a 3-inch-high berm erected just past the perimeter of the planting hole to funnel water to the root ball and wet the hole or sidewall interface. Berms should not be constructed in clay soils or on heavily compacted sites.
- Mulch all trees with 3 to 4 inches of shredded mulch or composted brush chips immediately after backfilling.

- Mulch should extend past the diameter of the tree planting pit at least 6 inches or all side of the tree ring.
- Maintain 3 to 4 inches of mulch annually.
- Keep mulch away from the tree trunk. Mulch should taper from the 3-inch depth back to grade right at the trunk to avoid decay of bark tissues.
- Water newly planted trees weekly through the first three growing seasons.
- Trees should receive approximately 1 inch of water per week including rainfall.
- Suppress weeds within the mulch ring to eliminate competition and for aesthetics in formal parks and along streets.
- Weeds and/or turf should not be allowed to grow up to the tree trunk at any time. This increases the likelihood of mechanical trunk injury.
- See Section 6, Plant Beds, for maintenance of trees in shrub beds.
- Ideal planting seasons are fall (October through December) and spring (March through May).
- Stake only in situations where normal planting procedures do not provide a stable plant. Otherwise, staking is generally not required.
- Staking is sometimes recommended as a vandal deterrent device or to prevent mechanical injury from mowers or trimmers.
- Stakes shall be removed at the end of the first year.
- Plant trees at the depth they were grown in nursery.
- Do not wrap tree trunks.
- Remove tree trunk wrapping materials, tags, and all ties at time of planting.

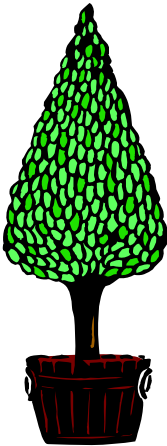


### Natural Area Planting

1. Prepare the site by scalping all vegetation out of a 5-by-5-foot area.
2. Clear the area to bare soil.
3. Plant the tree as indicated above in the center of the scalped area.
4. Maintain the 5-by-5-foot area free of competing vegetation for 3 years.

5. Place wood stakes next to (but not affixed to) each new tree. For visibility, paint the top of the stake or attach Hi-Vis flagging. These stakes are not to be used for stability, but rather for locating new stock during the establishment period.
6. Depending on size of stock, staking may sometimes be needed. Follow staking directions listed above.
7. Water the new trees during summer drought stress periods as needed for the first two to three establishment seasons

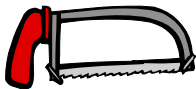
### Container/Bare Root Planting



- Container plants shall have the container removed prior to placement in the planting pit.
- Tease pot-bound roots with hands or tools prior to final placement in planting pit.
- Bare root plants shall be protected from root drying prior to and immediately after planting.
- Cleanly prune exceptionally long roots to create a uniform root mass.
- Take care to plant bareroot stock at the same grade as grown in the nursery.
- See Figure \_\_\_\_\_ for bareroot/container planting diagram.

### Tree Removal

See Section 1, Construction Site Management, for more detailed BMPs on tree removal.

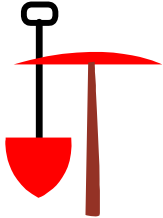


- Derelict trees that cannot be made safe or functional by corrective pruning shall be candidates for removal.
- A tree must be defective and have a target to be considered a hazard.
- Hazard shall be the first determining factor in removal decisions.
- Trees may present a risk because of old age, storm damage, poor structure, old construction activities or death of the tree.
- Trees that constitute a high hazard shall be removed if no other prescription will eliminate the risk.
- Causes of tree failure include poor tree architecture, summer branch drop, increased exposure, root loss, unstable rooting, girdling roots, leaning trees,

## 7. Trees

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unfavorable soil conditions, cracks, cankers, conks, seams, decay, cavities, and root and butt diseases (see *Tatum Guide* for visual clues).

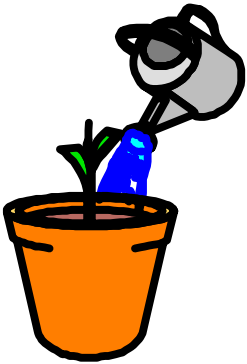


- At times, trees may be removed for new park construction, access or other issues not related to tree viability.
- If trees are smaller than 10 to 12 inches in diameter, it is possible to transplant them with a large treespade. The cost of treespading should be weighed against the cost of replacing the tree with a new smaller caliper tree. Establishment of larger trees is often less successful than planting a new one.
- The value of the specimen to be transplanted should also be taken into account when deciding on removal or replacement rather than transplanting. Different methods of appraising value are reviewed in the 8<sup>th</sup> edition of *Guide for Tree Appraisal* produced by the Council of Tree and Landscape Appraisers.
- Due to the sensitive nature of tree removal, the SUF will notify Department management and undertake the necessary public process to alert people to the work planned and to provide opportunity for comment.

### 7.6 Cultural Care

The following are the management practices that prevent trees from becoming either damaged or susceptible to disease.

#### Watering



- In general, established trees do not require supplemental watering except during periods of extreme drought.
- Valuable, specimen trees may be watered during periods of extreme drought.
- Turf irrigation around established trees needs to be modified to accommodate the water requirements of the trees.
- Water spray on trunks can lead to decay in some species.
- See Section 2, Water Management, for additional information on watering practice.

## 7.7 IPM

### Pest Tolerance Thresholds

- In general, insect and disease pests in trees are tolerated.
- Insect or disease pests in selected, high-value specimen trees may be subject to control measures.

### Pest Management Control Strategies

Integrated Pest Management for trees involves insects, disease, and physical damage to trees.



#### Insects

DPR does not actively control insect pests in trees, particularly tall trees that might require use of large aerial spray equipment. Such equipment carries with it a high probability of insecticide drift.

The following measures are used when insect pests are controlled in trees:

- Trees that are highly susceptible to specific insect pests (such as blue spruce and spruce aphids) may be removed from the landscape and replaced with resistant species.
- When possible, the portion of the tree affected by the insect (such as tent caterpillars) can be physically removed, eliminating the pest.
- An insecticide may be applied to control a specific insect pest in very selected situations. These scenarios include pests on specimen quality trees at special gardens or in high-visibility locations where the presence of the pest threatens the life of the tree. In these situations, general foliar applications will not be made unless the potential for product drift can be controlled.
- New injection technology may allow for systemic control of certain insect pests with minimal or no impact to human or environmental health. DPR will continue to explore this technology as a potential control for insect pests that may threaten the health of valuable park trees.

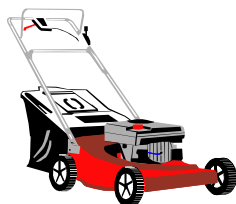
### Disease



DPR does not actively control disease pests in trees. However, increased concern for the Pacific Madrone and concern about Dutch Elm disease may require DPR to become more proactive in managing disease pests in significant trees populations. As with insecticides, it is unlikely that the department will subscribe to general foliar applications of fungicides or similar pesticide products to control disease pests in trees. The following are IPM control measures that can be performed:

- Trees susceptible to particular disease pathogens maybe removed from the landscape and replaced with resistant varieties.
- When possible, parts of trees affected by disease should be pruned out and properly disposed to stop the spread of disease within the tree and to adjacent trees.
- An appropriate fungicide may be applied to control a specific disease pathogen in very selected situations. These cases include specimen quality trees in special gardens or in high-visibility park locations where the presence of the disease threatens the life of the tree. In these situations, general foliar applications will not be made unless the potential for product drift can controlled.
- New injection technology may allow systemic control of certain diseases in tree pests with minimal or no impact to human or environmental health. DPR will continue to explore this technology as a potential control for disease pests that may threaten valuable trees.

### Physical Damage to Trees



Physical damage to trees can be a major factor in overall tree loss. This damage most often occurs in one of two ways. The first happens when trees are repeatedly struck by mowing equipment. The second is damage from string trimmers, which can cut the bark and ultimately kill a tree. Many trees are also lost to lack of appropriate care during construction projects within existing parks. The following IPM controls can reduce damage to trees:

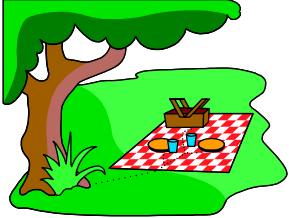
- Removing turf from around the tree base to create tree rings 3 to 4 feet in diameter can substantially reduce damage caused by mowers and trimmers. With tree rings, a mower or trimmer never has to come close enough to the tree to cause damage. The tree ring will need to be kept free of grass and weeds (see Section 3, IPM, under "Turf").
- Following the BMPs in Section 1, Construction Site Management, substantially reduces or eliminates damage from construction activities.

## 7.8 Training



- All park maintenance field staff should receive training on basic tree maintenance, tree problem diagnosis, and tree hazard identification.

### 8.1 Purpose



Turf provides a forgiving and resilient surface for many recreational activities and is the traditional "green carpet" visitors associate with parks. Most of DPR's 2310 acres of developed parkland is turf. Because turf varies substantially in use, so do turf management practices. Maintenance and management of park turf is a major DPR program. Appropriate management ensures both high quality turf where it is needed such as on athletic fields and golf courses and that the designed use of a site can be met.

### 8.2 Definition

**turf:** technical term applied to any lawn or grasses grown in a park or park facility. Turf areas vary widely in type of use from highly maintained athletic fields and golf courses to park meadows.

### 8.3 Background

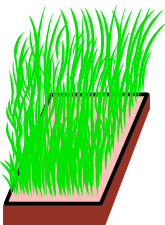
The park system offers visitors a wide variety of turf, including lawns (both formal and informal), athletic fields, golf courses, meadows and other kinds of turf. Of the 1400 acres of turf in the system, 200 are in athletic fields, 460 in golf courses, with the remainder in lawns. Each of type of turf requires a separate best management practice. The intensity of management ranges from very highly maintained golf course turf to meadow areas that may get mown only once a year as a fire prevention measure.

### 8.4 Design

The following are design considerations that improve the quality of turf plantings.

#### Construction Issues

- Turf areas should be constructed with a minimum slope of 2% to promote surface drainage and a maximum of 25% to allow riding mowers to safely access the areas.
- If possible, the soil should be amended with sand to provide a drier surface area. Dry areas allow easier and earlier (in the mowing season) maintenance.
- Trees, signposts, benches and other park amenities should be carefully placed in turf areas to reduce the need for hand trimming. If possible, these amenities should have the turf immediately surrounding them removed (such as for a tree ring) for the same purpose.



## Plant Selection

Selection of grass species is based on site conditions, expected usage, and maintenance standards. Sites with optimum growing conditions and high maintenance standards are seeded with blends of several species of perennial rye grass. Sites with poor drainage, partial shade, and limited fertilizer applications require blends of perennial rye grass, red fescues, and Chewings fescues.

## 8.2 Maintenance Practices

The following guidelines apply to all DPR turf plantings.

### Mowing

**Frequency.** The importance of regular mowing for promoting healthy turf cannot be over emphasized. Growth should be monitored and frequency increased to avoid removing more than 1/3 of the leaf blade. The following is the basic standard for mowing frequency:



Season	Frequency
March - October	Weekly
February - November	Bi-weekly
December	At least monthly

**Cutting Height.** A mowing height of 1.5 to 2 inches promotes healthier turf than shorter cutting because it leaves deeper rooting and it shades the weed seed germination zone. Lower cutting height often results in scalping spots where the ground is uneven.

**Mulch Mowing.** Grass clippings should rarely be removed from mowed turf areas. The plant nutrients and organic material they contain play an important role in developing a healthy, productive environment for root growth.

- Mowing patterns must be alternated to avoid ruts and compaction from the wheels.
- Avoid driving on frozen turf.
- Avoid driving on wet ground where ruts will remain. Walk the site during wet conditions to do a visual inspection.
- Mowing equipment must be maintained regularly, especially sharpening and adjusting of cutting edges.

### Trimming

- Trimming is performed by walk behind mowers and line trimmers in areas that cannot be accessed by riding mowers.
- Trimming should be coordinated with other mowing activities on the site.

### Edging

- Turf edging is done to give a finished look to lawn areas that border paved surfaces or planting areas. Edging is performed 2 to 4 times per year, depending on the maintenance standard for the site.
- At high maintenance locations, edging will be performed at a higher level of frequency.

### Irrigation

- Monitor automatic irrigation effectiveness on a weekly basis.
- Apply approximately **1 inch** of water per week. The most desirable frequency is once per week if percolation rate and moisture holding capacity will allow. Theoretically, the irrigation cycle should be extended to the point just before drought stress occurs. This period varies with soil conditions, weather, site usage, and maintenance practices.

## 8.3 Cultural Care

The following BMPs prevent problems with turf.

### Fertilization

- Soil test fertilized turf on a 2-year cycle.
- Turf fertilizer should be 5-1-4 NPK unless otherwise indicated by soil tests.
- Each application should apply approximately 1 lb. of N per 1000 square feet.
- Fertilizers N should be approximately 50% water insoluble N, with some organic sources. This percentage can be lower during the growing season and higher from fall through spring.
- Avoid applications during heavy rainfall to avoid runoff.
- Avoid applications in very hot weather.

- Be sure irrigation is operational before growing season applications.
- Have sprinkler heads marked to avoid damaging them during truck applications.
- Add micronutrients and lime as soil tests indicate.
- Site-specific fertilizer restrictions must be observed. Site-specific cautions include not using any fertilizer near streams and wetlands and prohibiting phosphorus around Green Lake.

## Aeration

- Aerate 2 to 3 times per year using .75-inch hollow tines.
- Best periods: March/April, late June, and late August.
- Technique: make at least 2 passes at 90-degree angles.
- Areas with drainage problems should use deep-tine aerified 1-2 times per year using 1-inch-by-6-inch hollow or solid tines.

## Top Dressing

- General-use top dressing mix should be about 80% medium sand and 20% composted organic material.
- Frequency: most effective when done lightly and frequently.
- Each application should be about ¼ inch.
- Monthly applications are desirable in heavy wear areas during peak seasons.

## Overseeding

- Overseed entire area at least once per year.
- Best practice is to overseed in fall and slicer seed in spring.
- Overseed rate is approximately 5 lb./1000 sq. ft.
- The following site characteristics, usage, and maintenance practices guide seed selection:
  - Ideal sites (full sun, good drainage, and reasonable fertility) are suited for perennial ryegrass blends.
  - Lawns that are in partial shade or poorly drained should be seeded with mixes of perennial rye and fescues.

- Generally, Kentucky Bluegrass should be avoided. It can, however, be used in athletic field seed blends if it is no more than 10% of the total seed count.

### Site Standards

Site standards for turf varies by landscape classification such as that in front of the Seattle Art Museum, Volunteer Park Conservatory and other related facilities. These categories include prominent, general, and non-irrigated lawn areas, steep slopes, meadows, soil- or sand-based athletic fields, and bathing beaches.

#### Prominent Irrigated Lawn Areas

These are high-visibility or high-use landscapes. Some examples are community center lawns, popular picnic or sunbathing areas, lawns adjacent to busy arterials, and smaller neighborhood parks where the lawn is the most significant amenity. Maintenance of these areas should be comparable to an athletic field with additional emphasis on trimming and edging.

- **Fertilization:** apply 5-1-4 NPK ratio at 2 to 6 lb. N per year in 3 to 4 applications.
- **Aeration:** should occur 2 to 3 times per year with conventional 0.75-inch hollow tines.
- **Overseeding:** the entire field at least once per year at 5 lb. per 1000 sq. Monthly applications should occur in heavy wear areas.

#### General Irrigated Lawn Areas

These are lawn areas in parks of various types where irrigation is available.

- **Fertilization:** apply 5-1-4 NPK ratio at 1 to 2 lb. N per year in 1 to 2 applications.
- **Aeration:** should occur 1 to 2 times per year with conventional 0.75-inch hollow tines.
- **Overseed** as needed. Best done April/May and October.

#### Non-Irrigated Lawn Areas

These are lawn areas in parks of various types where irrigation is not available.

- **Fertilization:** apply 5-1-4 NPK ratio once October/November.
- **Overseeding:** As needed. Best done in October.

## Steep Slopes

- Control grass growth mechanically with string trimmers.
- Spray with Embark™ or other turf growth regulators to extend trimming cycle.
- Consider leaving unmown or mowing 1 or 2 times per year.
- Consider replacement of existing slope vegetation with “low grow” turf cultivars or woody groundcovers.



## Meadows

Meadows are unique environments that function primarily as wildlife habitat.

- Mowing should be infrequent with the goal being brush suppression and fire control. Analyze site for potential fire threat and fire control strategies.
- Successful establishment of native species requires that they have the opportunity to set and release seed before mowing.
- Site access routes should consider maintenance, interpretive value, and habitat preservation.
- Species selection should be matched with existing available groundwater.
- Location of meadow should attempt to link other wildlife areas into larger contiguous habitat areas.
- Scheduling and timing should minimize impacts to wildlife nesting and habitation.
- One mowing every 2 to 3 years may be sufficient for woody brush control. Firebreak areas may require more frequent mowing to maintain. Mowing heights should be 3 to 5 inches.

## Soil-Based Athletic Fields

These athletic fields are generally composed of native soil formed on-site with minimal amendment. These facilities are characterized by scheduled play. Drop-in fields are maintained as general irrigated lawn unless there is exceptionally high usage.



- **Soil:** test soil for pH annually. Add lime as needed to ensure optimum nutrient intake.

- **Fertilization:** apply 5-1-4 NPK ratio at 2 to 6 lb. of N/year in 3 to 4 applications.
- **Aeration:** should occur 4 times per year with conventional 0.75-inch hollow tines. Field should be deep-tine aerified every 1 to 2 years.
- **Overseeding:** the entire field at least once per year at 5 lb./1000 sq. ft. or about 375 lb. per soccer field. Monthly applications should occur in heavy wear areas such as the goalmouth during the playing season.

### Sand-Based Athletic Fields

These fields are entirely composed of imported sand and are known for their outstanding drainage capability.

- **Irrigation:** more frequently than on soil fields
- **Fertilization:** apply 5-1-4 NPK ratio at 3 to 6 lb. of N/year in 6 to 8 applications. An organic-based product should be applied a minimum of 1 time per year to increase microbial activity.
- **Aeration:** should occur 2 to 3 times per year with conventional 0.75-inch hollow tines. Deep-tine aerating every 2 to 3 years should also be done.
- **Overseeding:** the entire field at least once per year at 5 lb./1000 sq. ft. or about 375 lb per soccer field. Monthly applications should occur in heavy wear areas such as goalmouths during playing season.

### Bathing Beaches

- **Fertilization:** apply 5-1-4 NPK ratio at 2 to 6 lb. of N/year applied in 2 to 3 applications of a slow-release product.
- Special care should be taken to not fertilize in advance of heavy rains.
- **Aeration:** should occur 2 to 3 times per year with conventional 0.75-inch hollow tines.
- **Overseeding:** the entire lawn at least once per year at 5 lb./1000 sq. ft. Monthly applications should occur in heavy wear areas.

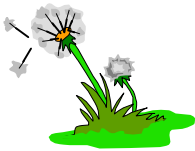
## 8.4 IPM

### Pest Tolerance Thresholds

- Weed, insect and disease pests are typically tolerated in general park lawn areas.

- Turf pests in highly maintained turf such as athletic fields, bathing beaches and other high-visibility/high-use areas are generally controlled through good turf cultural practices.
- Only in rare situations are pesticides applied to park turf areas.
- Because of the unique conditions present on golf courses, a variety of pest control measures are used, including mechanical, cultural and chemical.

## Pest Management Control Strategies



### Broadleaf Weeds

As discussed, weeds in turf are generally tolerated with the exception of those in golf course turf and a few high-visibility park turf areas. When control is necessary, the primary method is through the following cultural practices:

- careful monitoring of watering practices
- fertilization
- aeration
- top-dressing
- overseeding.

By performing this preventive maintenance, park turf is healthier and better able to compete with various broadleaf weeds.

Chemical weed control will be used only as a last resort for controlling particularly difficult weeds in high-visibility turf areas.

- In these rare situations, the least toxic, least residual pesticide will be used for spot treatments.
- General broadcast treatments will be avoided.
- The timing of such applications will be made to avoid contact with the public to the extent possible.
- Posting of the site that has been treated will be done as legally required.

Maintenance for City's golf courses generally does control for broadleaf weeds through cultural practices and spot application of carefully selected herbicides.



### Wood Brush Control

Woody brush control in meadow areas may require the use of Roundup Pro® or Garlon 3A® if alternative control measures will not provide control.



### Insects

The only real insect pest of significance for turf in Seattle is the European crane fly. While it can be quite damaging to turf areas, the crane fly is not treated by prophylactic control in Seattle parks.

- Chemical control is used only in the rarest of circumstances on turf of very high visibility and value such as golf course turf and very selected high-visibility/high-use park turf areas.
- Any chemical applications will be spot treatments directed specifically at the turf areas containing the pest.



### Disease

**General Park Turf.** Disease in general park turf is generally tolerated and is not actively controlled.

- In high-use/high-visibility park turf areas, disease will be controlled to a considerable degree by sound cultural practices.
- Pesticides are not used to control disease in park turf areas.

**Golf Course Turf.** Because turf disease can be a real problem on golf courses, it must be controlled to preserve the function of this asset. Golf course turf, particularly greens and tees, must perform under extreme conditions of maintenance and use. These conditions make golf course turf more susceptible to disease than is other park turf.

- Golf turf disease is controlled through good cultural practices to the extent possible.
- Certain diseases are controlled through the application of an appropriate fungicide.
- When used, fungicides are applied to the diseased turf only, such as a green.
- The least toxic and still effective products are used.
- The type of fungicide used will be changed from year to year to reduce the chance of the turf disease developing a resistance to the chemical control.



### Grass Trimming Abatement

Controlling grass along fence lines and around trees and other landscape features helps preserve the asset by allowing large riding lawn mowers to steer clear of objects. This routine maintenance activity is especially important around trees where mower damage can easily lead to tree loss. An additional advantage of grass trimming abatement is that it makes parks appear clean and well kept. This

image, in turn, has a positive impact on how the public uses our facilities. Well-maintained parks experience less vandalism and misuse. Grass trimming is accomplished in the following ways:

- **String trimmers or push mowers.** Grass is trimmed using gas-powered string trimmers or push-type lawn mowers. This practice is very labor intensive, costly, and produces noise and air pollution.
- **Herbicide.** This work is also often performed through the annual (or less frequent) application of the herbicide Roundup Pro®. This product is sometimes used in conjunction with Surflan® to provide ongoing pre-emergent control of weed and grass seed not yet germinated in tree rings and similar areas.
- **Concrete mow strips.** As resources are available, it is sometimes possible to provide a “mow strip” of concrete or a similar low maintenance product around some landscape features to eliminate the need for grass trimming. This control option is costly and doesn’t work in all situations.

## 8.5 Training

- All park maintenance field staff should have training in basic turf management.
- The DPR mower operators have specific training regarding mowing heights and patterns.

### 9.1 Purpose



The Seattle Park system contains more than 4.5 acres of natural area, making it a vast resource of varied ecosystems. Within the 760 acres of park-owned watershed, flow more than 8 miles of urban creeks capable of supporting salmon and trout. The park system is also rimmed by more than 21 miles of lake and saltwater shoreline, much of it a natural state. Seward Park alone protects more than 130 acres of old-growth Douglas fir. Many other park greenbelt properties support aged second growth deciduous forest heavily challenged by non-native invasive plants like English ivy and Himalayan blackberry.

The City of Seattle Department of Parks and Recreation (DPR) has begun developing meadow environments in selected parks to enhance wildlife habitat while simultaneously reducing maintenance needs. It is a rich tapestry of natural environments and ecosystems that only recently have begun to receive the management attention they deserve. Thoughtful management of park natural areas is essential to ensuring the quality of life enjoyed by Seattle residents and to the successful recovery of salmon habitat.

### 9.2 Definition

**Class "A" weeds:** Class A noxious weeds are non-native species with a limited distribution in Washington State. Preventing new infestations and eradicating existing infestations is a high priority in managing these weeds.

**ecological weeds:** any weed such as English ivy or Himalayan blackberry that threatens the balance within an ecosystem.

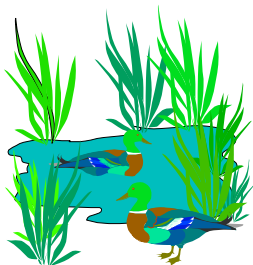
**environmentally critical areas:** are areas determined by the City's Department of Construction and Land Use (DCLU) to be particularly environmentally critical. These areas include steep slopes and wetlands.

**forests:** these natural areas are undeveloped landscapes that do not fall into any of the classifications above. Forests contain tall and predominantly woody vegetation.

**meadows:** non-forested areas having 25% or less tree cover. Meadows include the following sub-classifications: sparsely vegetated, grassland forb, shrub savannah, shrubland, and tree savannah.

**natural areas:** in this manual, "natural area" is used to describe any City-owned property with critical environmental resources. Natural areas shelter native ecosystems and wildlife habitat. These sensitive areas and habitats include nearly all classifications in the City's Regulations for Environmentally Critical Areas or ECAs. Natural areas fall into a number of categories, which include steep slopes and slide prone areas. For this BMP manual, these resource assets are divided into three major groups:

- forests



- meadows
- wetlands, riparian corridors, shorelines and aquatic habitats

**riparian corridors:** wetland and terrestrial areas within the influence area of the adjacent stream. Technically they are defined as:

... all areas within 100 feet measured horizontally from the top of the bank, or if that cannot be determined, from the ordinary high water mark of the watercourse and water body, or a 100-year flood plain as mapped by FEMA, as regulated by the Seattle Floodplain Development ordinance, whichever is greater.

**shoreline and aquatic habitats:** areas affected by the hydrology of a water body (pond, lake, sound). The area 200 feet landward of water is the shoreline zone. Shorelines include several subclassifications:

- estuarine – brackish water between 0.5 and 30 parts per thousand (ppt)
- lacustrine – mostly open water
- marine – salt water of greater than 30 ppt
- palustrine – includes open water and emergent habitats, including freshwater wetlands (see "wetlands" definition above).
- riverine – same as riparian corridor (see "riparian corridors" above)

**social trail:** a trail within any natural area formed by casual use rather than design.

**wetlands:** those areas inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

### 9.3 Background

This section defines general habitat features of natural areas and human use problems common to these sensitive environments.

#### Habitat Features

The habitat needs of wildlife prevail in natural areas. Maintenance activity should increase habitat value. For example, hazard trees in a natural area create an opportunity for a snag. In that light, aquatic features like pools or instream woody debris are maintained even if doing so decreases drainage. Likewise, a meadow should link other wildlife areas into larger, adjacent habitat areas.

### User Access/Control

Access to natural areas must be clearly defined. People can quickly overwhelm these sensitive resources. The best way to define access from trails, shorelines, and service roads is a study of predominant use patterns. These routes should then be developed and maintained using the BMP for trails that will be added to this BMP in the near future. Other access must be restricted to prevent further damage. Close any excessive and redundant social trails and create barriers and plantings that make them inaccessible.

Domestic pets can potentially cause more damage than people. Dogs and cats can destroy vegetation and kill or maim wildlife. Pets in parks must be on a leash except for designated off-leash areas.

### Vandalism and Theft


All living and non-living resources found in natural areas are the property of the City of Seattle. Unfortunately, natural areas are subject to theft and vandalism of park property. Cutting trees, collecting plants, harassing wildlife and gathering firewood are all prohibited. Cases of vandalism and theft will be prosecuted. Subchapter II of the City of Seattle Park Code protects these resource assets from vandalism. Section 18.12.070 states:

It is unlawful for any person...to remove, destroy, mutilate or deface any structure...lawn, ...shrub, tree...plant, flower...in any Park.

Any person convicted of vandalizing park property may be punished by a fine in any sum not to exceed \$5,000 or by imprisonment in the City Jail for a term not to exceed 1 year or by both fine and imprisonment.

## 9.4 Planning

Because citizen stewardship is our primary means of maintaining and restoring natural areas, project managers need to involve citizen constituencies in planning. This involvement includes setting goals, objectives, and priorities. Use the checklist below to plan maintenance in natural areas. Do the steps in order:

Maintenance Planning Checklist for Natural Areas			
1	Set goals with DPR staff and public constituencies		
2	Define a scope of planning work based on these goals		
3	Inventory the site's natural resources and human-use patterns		
4	Analyze where site resources are not achieving intended goals		
5	Develop recommended strategies for correcting deficiencies. Set priorities according to both natural resource and human-use issues		
6	Present these recommendations to the general public for comment. Modify them as necessary.		

## Boundary Delineation and Inspection

- A registered surveyor should locate City-owned boundaries. Indistinct boundaries should be signed with labeled, white fiberglass boundary stakes or by other visible and durable means.
- City property boundaries should be inspected annually. The preferred inspection tool is a geographic positioning system (GPS) attached to a datalogger. The datalogger can be used to track typical boundary issues such as tree liabilities or non-park uses.
- Sensitive area boundaries such as riparian corridors and wetlands should be clearly located on City maps. This requirement goes beyond that of the City *Critical Areas Inventory*, which does not identify all “sensitive areas.”

## Resource Inventory

A qualified botanist or urban forester shall supervise landscape inventory. Management units are generally defined by vegetation, soils, hydrology, topography, aspect and site history. DPR prefers that all data is collected digitally or translated into a format compatible with ArcInfo GIS.

Distill what you learn during a resource audit into a written report that includes both a social and a natural history of the resource. The following table shows you where to look.

## 9. Natural Areas

Sources for Resource Inventory Information		
<b>Site Boundaries</b>	The best tool for approximating boundary locations is our Geographic Information System. GIS orthophotos can superimpose property boundaries to locate right-of-way or park boundaries.	
<b>Site Description &amp; History</b>	Several sources can give you this data:	
Parks Department	Start with DPR's Property Management and Real Estate Section. Or try plan and site files at the Facilities Maintenance and Development Division.	206-684-7031
Engineering Department	For street right-of-way projects and for general property maps, visit the City's engineering records vault.	206-684-5132
Archives	City Archives contain much historical information, including old aerial photos and newspaper articles. Be sure to look for the Sherwood documents for park sites. Copies are also available in the Seattle Public Library's Northwest Collection.	206-684-8353
Staff	City staff can give you detailed information on site history. Get in touch with a Crew Chief or a Senior Gardener who maintains the site.	
Residents	Seek out long-time residents through your community council or Neighborhood Service Center. They can probably give you some unique oral history.	
GIS	The GIS system maps critical areas (e.g., steep slopes).	

### 9.5 Design

The following design considerations preserve the aesthetic and environmental value of natural areas.

#### Plant Selection

In restoration projects, plant selection should reflect successional stage at a site. Species will typically be predominantly native and based on site ecology

(moisture, sun exposure). Phased planting that establishes a canopy before attempting to restore subordinate layers generally works better than comprehensive, one-time restoration plantings.

### Powerlines and Other Utilities

Don't plant big trees under powerlines. Select trees and shrubs that will provide required clearances at their mature sizes. Use directional pruning where aesthetic factors justify the additional cost.

### Views

The City of Seattle maintains viewpoints throughout the city. Standard practice has been to prune and top trees in view corridors. The goal for vegetation at viewpoints should be to convert view-blocking vegetation to lower growing species that will not require long-term pruning. This goal is measured against other goals for habitat, aesthetics, and erosion control.

### Drainage

Site improvements should work with the existing natural drainage patterns. For example, drainage course design should assess ground moisture levels to ensure appropriate moisture levels for self-sustaining plant growth. Such a project could also include the construction of check dams, bioswales and sediment ponds to improve water and habitat quality.

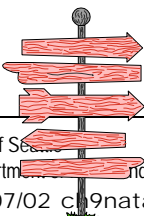
Existing drainage systems should be maintained according to the preventive maintenance schedule and specifications. DPR resource crews are responsible for routinely cleaning catch basins, culverts, and other drainage structures.

### Hydrology

Each site has a unique hydrology. Preserving a site's natural hydrology preserves the integrity of its other resources. Concentrating drainage in the stormwater system should be done only where the natural system is overburdened by external conditions such as street runoff or private drain systems. These external sources should be mitigated by detention before they enter the natural system. Dispersed flow maximizes detention of natural areas. Site features that concentrate flow such as trails and roads should be built to redisperse flows, if possible. Consult Seattle Public Utilities' *Standards and Drainage Policy Study* recommendations when planning site hydrology.

### Interpretive Signs

The success of natural area management depends on the understanding and cooperation of park users. Signs are the primary tools for eliciting such assistance. There are several standards currently used for natural areas:



## 9. Natural Areas

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- **Open Space Rainbow Sign.** This is a variation on the standard DPR rainbow sign that signifies the main access point for an open space site.
- **CIP Project Sign.** This is an approximately 2-by-3-foot temporary sign with customized text to inform park users of specific aspects of a project.
- **Kiosk.** This is a large-format glazed bulletin board in a shelter for posting current information and seasonal interest items for park users.
- **Trail Directional Sign.** This is a 1-by-1-foot post-mounted plaque that directs trail users to various destinations within a park.
- **Topical Education Sign.** These are customized signs in various formats that provide specific information on natural resource topics. They are typically porcelain enamel, etched stainless steel, coated, or otherwise constructed to resist vandalism.
- **Regulatory Sign.** These include Parks Code, dogs on-leash, no bicycles, and no dumping signs. These should be combined with other permanent signs where possible to minimize sign clutter.

### Permits

Most of Seattle's environmentally sensitive habitats fall under jurisdiction of the Department of Construction and Land Use (DCLU). Activities in these areas should conform to the following:

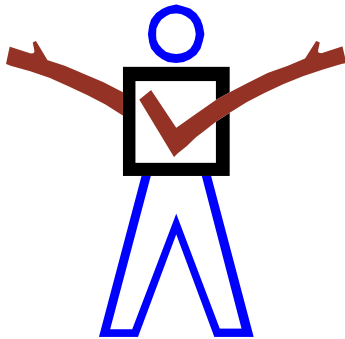
- DCLU's *Environmentally Critical Areas Regulations* (1992)
- DCLU's *Best Management Practices for Construction Erosion and Sedimentation Control Plans* (1993)
- *Environmentally Critical Areas Interdepartmental Standard Operating Procedure* (1994).

Maintenance, repair, strengthening or other operations that require substantial disturbance require notification of or permitting from DCLU. Permits in stream corridors may also require a hydraulic permit application to the Washington State Department of Fish and Wildlife.

### Wetland Construction

Wetland construction is complex; professional designers should lead it. These specialists use the following techniques:

- shoreline armoring
- bioengineered installations using wattle, netting, rooted cuttings, etc.
- detention structures



- trail structures boardwalk design (pin piles).

## 9.6 Maintenance Practices

The goal of routine maintenance in natural areas is to conserve and enhance water, soil, and wildlife resources in or expected in a given habitat.



### Inspection

Natural and sensitive areas in urban environments require routine monitoring of the following:

- Public use, such as high impact or illegal activity
- Public safety, such as hazard trees, police and fire access
- Natural processes such slides, erosion, drainage
- Fuel loading
- Silt loading of water bodies
- Presence of invasive plants
- Water quality and upstream impacts (see "Inter-Agency Water Quality Monitoring" ahead in this section)

### Drainage

Drainage features should be inspected annually, preferably in late November or early December to ensure proper function throughout the rainy season. Organic debris and excess sediment should be removed as needed to allow unrestricted flow and optimal storage volume.

### Litter Control/Dumping

Natural areas are subject to litter and dumping activity. BMPs include:

- frequent inspection of trailheads and street ends
- responsive clean-up when incidents are reported
- investigation of dumped materials to identify the perpetrator
- involvement of Hazmat specialists when unknown chemicals are detected
- prosecution of cases with sufficient evidence.

### Mowing

Mowing should be infrequent. The goal is to suppress brush as a means of fire control. Scheduling and timing should minimize impacts with wildlife nesting

## 9. Natural Areas

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and habitation (usually after August 1st is best). One mowing every 2 to 3 years may be sufficient for woody brush control. Firebreak areas may require frequent mowing to maintain. Mowing heights should be approximately 4 to 5 inches. See SEATRAN for clearance standards on streets. Where slopes are involved, mowing should be selective to preserve native plantings.

### **Hazard Tree Conversion**

Trees in natural areas that are identified as hazards should be evaluated for habitat potential and converted to snag, log or other habitat feature if site conditions warrant.

### **Pruning**

Pruning can also be used to enhance habitat by laying down woody debris and snag creation.

### **Trails**

The maintenance of trails hinges on the construction and maintenance of proper drainage systems along trails. See "Drainage" above. Trail surfaces can be composed of bare mineral soil, wood chips, or crushed gravel. The existing surface can be maintained by adding the same material that is already there. Do not mix surface treatments.

### **Beaches**

The unstable nature of shorelines requires that beaches be carefully maintained to prevent loss of the facility and/or adverse environmental impacts. Strategies include the following:

- sand and cobble replenishment
- driftwood retention
- periodic inspection by divers
- routine raking of sand surfaces.

## 9.7 Wetlands, Riparian Corridors, Shorelines & Aquatic Habitats

For years, park maintenance has meant conserving trees and plants. Today we recognize that water environments are equally important as resource assets. Seattle parks contain more than 1000 acres of wetlands, riparian corridors, shorelines and aquatic habitats. This section describes the BMPs for managing water environments in Seattle Parks.

## Inter-Agency Water Quality Monitoring

Agencies that manage City-owned open spaces cooperate with many jurisdictions to preserve and improve water quality. These other agencies include:



### How to Coordinate with Other Agencies

Agency	Type of Coordination
Department of Construction and Land Use ( <b>DCLU</b> )	<ul style="list-style-type: none"> <li>Advise them through standard operating procedures of projects that may substantially impact environmentally critical areas.</li> <li>DCLU must participate in any review process for projects in watersheds that drain through City property</li> </ul>
Seattle Public Utilities ( <b>SPU</b> )	Monitor water quality and streambed conditions to document the effects of management practices and development on water quality.
Washington State Department of Fish and Wildlife ( <b>DFW</b> ).	Obtain a Hydraulic Permit for any project that might impact a fish-supporting watercourse.

## Shoreline and Bank Stability

Armoring a shoreline should consider the least impact necessary to achieve reasonable stability. BMPs include:

- Traditional use of riprap should be limited to severe exposed sites. Softer treatments, such as log placement and bioengineered plantings, are preferred where feasible.
- Shoreline improvements and interpretive features should be used to direct usage and interpret non-traditional treatments. Seasonal variations in water (lake or stream) level require additional engineering.

## Structures

Structures are constructed features—check dams, water bars, sediment pool, boardwalks, bridges, or stairs—built to mitigate urban impact on sensitive areas.

- Structures should neither interfere with nor dominate natural processes.

## 9. Natural Areas

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- Structures should be designed and constructed to endure extreme exposures, including unstable ground and constant wetness.
- Planning should ensure construction impacts are minimized.

### Beaches

The unstable nature of shorelines requires that beaches be carefully engineered to prevent loss of the facility or adverse environmental impacts such as those from park users. Beach engineering includes importing sand and cobble, armoring, and installing geotextile. Jetties, groins, seawalls and other retention structures are ineffective shoreline management.

### Buffers

The transition between natural areas and developed landscapes needs special attention in urban settings. Edges are also some of the most diverse and productive habitats in urban environments. <<(photo of forest edge transition)>> We maintain the transition between a highly managed or disturbed landscape and a relatively undisturbed landscape by following these BMPs:

- less frequent mowing
- restricted access
- landscape designs that blend the two resources and provide interpretation
- dense plantings and extra weed control.

## 9.8 Forests

The following BMPs guide best practice for forest cover, canopy regrowth, erosion control, steep slopes, organic debris and fire prevention.

### **Vegetative Cover**

Healthy vegetation cover is important for erosion control, habitat, and invasive weed control.

- Except in features that cannot function with vegetative cover (e.g. trails, cliff habitats), vegetation will be preserved and enhanced to maximize its functional value.
- Wherever possible, enhance the conditions that are favorable to desirable vegetation and inhibit undesirable vegetation.
- Limit disturbance and changes to site conditions to prevent loss of plant biomass

### **Canopy Regeneration**

Except for grassland/meadow habitats, tree canopy is an integral part of the natural ecosystem. Use the following BMPs to encourage canopy growth:

- Where canopy is fragmented or absent, new plantings should anticipate natural succession in native conditions. In general, Pacific Northwest forests proceed from a pioneer deciduous forest to a predominantly conifer forest.
- While management practices should emulate natural succession, for practical reasons, successional stages may be accelerated, retarded or staggered. For example, you might create canopy gaps to stimulate tree growth in the understory at a particular site.

### **Vegetation Management Controls Erosion**

- **Bare park** land, should be carefully evaluated and the appropriate vegetation established.
- If **bare earth** is evident, it should, at a minimum, have a layer of organic mulch applied to buffer the soil until the appropriate vegetation can be established.
- **Management decisions** should reflect the principles of plant succession leading to a multi-layered canopy, which provides the ultimate buffer to erosion.
- **Natural accumulations of leaf litter** and other organic materials should be left undisturbed on erosion-prone sites whenever possible.
- All streams should be buffered from **excessive runoff** and erosion by a comprehensive watershed study followed by appropriate corrective measures and maintenance.
- **Biofiltration of hardsurface runoff** water should be attempted whenever possible. Managing for healthy plant communities is a big element in the prevention of erosion. The grass in a forest can provide adequate erosion buffering provided it is healthy and vital.

### **Steep Slopes**

- Removing vegetation from the ground layer should be minimized, and plantings should be stabilized with appropriate bioengineering techniques (e.g. netting, wattling, hydromulching, etc.)
- Slide areas, or areas suspected of being slide-prone, should be evaluated by a geotechnical expert before extensive restoration begins.
- Stormwater runoff must be prevented from saturating or loading steep slopes. The appropriate drainage system should be in place and adequately maintained to intercept runoff flows before reaching the slope. See "Hydrology" above under Section 9.5, Design.

### **Slide Areas**

Slide areas, or those suspected of being slide-prone, will be evaluated by a geotechnical expert before extensive restoration is initiated. Strategies can be developed to help maintain or even improve slope stability. The standard practice of hydroseeding repaired slide areas is prudent but does not restore stability. To restore stability and prevent further soil erosion, woody vegetation

must be reestablished. See "Steep Slopes," "Erosion Control," and "Plant Selection" sections above.

### Organic Debris

Organic debris from maintenance practices will remain on site, as long as it does not interfere with other landscape functions. Types of interference include blocking trails, forming unstable cornices, diverting drainages, and smothering desirable vegetation. Wherever possible, use the following BMPs:

- Organic debris should be cut and dispersed to maximize ground contact.
- Chipping woody debris is useful as long as debris is left in 3-inch or shorter depths.
- Leave uncut branches and logs in place to restrict traffic into natural areas.
- Stabilize logs to prevent sliding or rolling.
- Remove invasive species from the site.

### Fire Prevention

A healthy, diverse plant community is fire resistant, but woody plant debris must be managed in any urban landscape. The following BMPs encourage fire prevention in natural areas:

- Excessive accumulations of dead, woody plant debris should be avoided. Thinly scatter this debris away from park use areas.
- If tree pruning or removal debris remains in a native woodland site, the material should be diced well enough to directly contact the ground.
- Maintain transitions to developed landscapes to provide interruptions to the normal path that fires usually travel. This practice creates a more defensible landscape.<sup>1</sup>
- Hydrants should be located along the edge of natural areas to provide immediate access for firefighting.
- Service roads into large woodland tracts should be maintained to allow access to Fire Department tanker trucks.
- Large woodland tracts with high fire potential should be studied for possible development of service roads.

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<sup>1</sup> DNR publication on Fire Defensible Landscaping

- Areas of known homeless encampments should be frequently inspected and cleaned up to minimize the potential for wildfires.

### 9.9 Meadows

The following BMPs guide best practice for grassland vegetative cover, meadow preservation, meadow restoration, habitat preservation, and fire prevention.

#### Grassland Vegetative Cover

Healthy vegetative cover is important for erosion control, habitat, and noxious weed control.

- **Exotic Grasses.** Most urban meadow sites are previously disturbed sites resulting in regrowth of primarily exotic grasses. Once established, these exotic species should be accepted as the primary component of the vegetative cover.
- **Native Meadow Plants.** Preservation of native plants should be attempted whenever possible.
- **Wet Meadows.** Many meadow areas in this region remain in a saturated condition for 6 months or more. Avoiding significant maintenance activities during this period is recommended. Preservation and introduction of appropriate native plants into these sites will help ensure a healthy vegetative cover.

#### Preservation

To preserve a grassland, wet meadow, or perennial meadow in the Pacific Northwest requires an ongoing maintenance program.

- **Disturbance.** Avoid creating holes in the vegetative cover because it will open opportunities for noxious weeds to invade.
- **Meadow Succession.** The natural evolutionary process of forest/meadow succession will eventually colonize meadow areas with shrubs and trees. The management of this process will have a major impact on the character and longevity of the meadow. The desired character of a meadow area should be defined. The meadow should be managed to prevent establishment of exotic trees and shrubs. Depending on the desired character of the meadow, all, some, or none of the native plants attempting to colonize the site can be retained.
- **Exotic Weed and Brush Control.** Scotch broom and other noxious weeds colonize many meadow areas, especially if the vegetative cover is

weak or not intact. If invasive brush is a minor problem, hand grubbing or spot spraying with a broadleaf herbicide are both options. When invasive brush is a major problem, it may be necessary to mow the meadow on an annual basis. Mowing should be timed to avoid disturbing wildlife. Spring should be avoided to allow protection for ground nesting birds. The site should be monitored for other wildlife activity before mowing occurs. Mowing should also be done before seed set of the targeted species. Mowing heights should be a minimum of 6 inches high to prevent excessive grass clippings and to minimize exposing bare ground.

## Restoration and Construction of Meadows

Restoration or new construction of a meadow should consider the following:

- **Hydrologic Study of the Site.** Available moisture is the determining factor in appropriate plant selection.
- **Soil Study.** Many native plants require specific soil requirements to succeed.
- **Existing Vegetation.** The site should be assessed for desirable species as well as undesirable species. A small test plot can also help determine the potential weed seed bank in the soil profile. A thorough inventory of existing species can provide valuable information for selection of appropriate species.
- **Natural Succession.** Whenever possible, attempt to emulate the natural succession process by initially introducing primarily pioneering plant species and gradually expanding into later successional species as cultural conditions allow.

## Wildlife Habitat

The management practices of meadow areas should reflect the goal of preserving and enhancing desirable wildlife species.

- **Maintenance Activities.** Maintenance activities should be evaluated as to their impact on wildlife and appropriate decisions made.
- **Enhancements.** Many desirable species can be attracted by enhancements such as nesting boxes, brush piles, rock piles, stumps, snags, and specific plants.
- **Environmental Education/Interpretation.** When resources are available, it is important to address environmental education. Educated park users are much more likely to preserve and protect a site.

### Fire Prevention

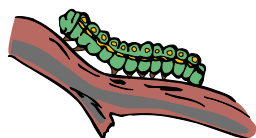
Wildfire prevention is an important aspect of meadow management. The following items should be considered when managing or creating a grassland.

- **Fuel Loading.** How much fuel does the site contain and what is the potential for an uncontrolled burn?
- **Site Geography.** Does the grassland connect to woodlands, structures, or other valued assets?
- **Fire Breaks.** Grassland areas should have established firebreaks. These breaks divide grassland and woodland areas from homes, park structures, or any other potentially flammable area. The firebreaks should be at least 25 feet wide and should be mowed frequently enough to prevent any buildup of dead grass. Closely mowed swaths and service roads can function as fire breaks. Plan the firebreaks to contain a grass fire to grasslands only.
- **Irrigation.** If a site has an irrigation system, it may be necessary to occasionally activate the system to dampen the potential fuel.
- **Mowing.** Site conditions should be monitored for the above items. Summer or fall mowing could be recommended if conditions indicate.

### 9.10 IPM

#### Pest Tolerance Thresholds

##### For All Natural Areas



- Weeds are generally found in these environments and many will be tolerated.
- Noxious weeds will not be tolerated and will be controlled when found.
- Invasive plants are generally not tolerated. Invasive plants will be controlled in conjunction with ecosystem restoration efforts in these environments.
- Only insect pests that pose a risk to the public (such as hornets) or to the resource (such as gypsy moth) will be controlled.
- Plant diseases will generally be tolerated unless a specific control can be employed that will be effective in ensuring the health of particularly valuable assets.

## Pest Management Control Strategies

### Weed Control



An overriding principle of IPM is the maintenance of healthy plant communities. That means weed control of the following types:

- **Timed mowing.** Carefully timed mowing before seed set can effectively reduce weed seed sources. Frequent mowing can eliminate blackberry and other woody species.
- **Mulching.** Mulching around the base of plantings is widely accepted as a horticultural practice for soil fertility and weed control. In most instances, composted wood chips or onsite recycle leaf litter are adequate materials. Avoid wood chips from diseased trees. Mulch should be between 2 to 3 inches deep for best results.
- **Weed watch during mulching.** Care must be given to not incorporate new weed problems with the import and use of mulch materials.

### Woody Brush Control



The control of woody brush like blackberries and poison oak is very important in certain park locations. Often these plants are found in transition areas between developed park areas and natural areas. If not controlled, woody brush can easily overtake forest-edge environments, eliminating vital habitat opportunities.

Control measures for woody brush include the following:

- Manual or mechanical removal using hand tools or gas-powered equipment.
- Chemical control with Roundup Pro® or Garlon 3A® can be employed when other measures are not possible or have failed. Spot applications are preferred whenever possible although area applications may be employed, especially for poison oak where handling by humans is dangerous. Any area applications will be limited to the area of infestation.



### Stump Re-Sprouting Control

Often there is a need to remove small trees and prevent re-sprouting of a stump. Methods for controlling the re-sprouting of stumps include the following:

- If the location of the stump will allow access by equipment, then it can be mechanically removed if the location is not within an environmentally critical area.
- Small stumps may be removed manually if they are not on steep slopes or in other environmentally critical areas.

- The re-sprouting of stumps can also be controlled by painting newly cut stump surfaces with Roundup Pro® (for some species) or Garlon 3A®. Care will be taken to limit the application of the selected herbicide to the stump surface only.



### Invasive Plant Control

Invasive plants have taken over many of the City's forested areas, radically changing pre-existing ecosystems. Attaining long-term control of invasive plants is essential to recovery and preservation of the City's natural ecosystems. Invasive plant control shall follow the guidelines established by the *King County Noxious Weed Board*. Except in the case of Class A weeds, the goal is suppression of weed populations to below threshold (damage causing) levels. Eradication of certain ecological weeds (blackberry or ivy) in all of the City's natural areas is neither feasible nor cost-effective. However, controlling spread of the problem and eradication in certain priority locations are DPR goals. Control methods include:

- Use *extent of removal* and *type of habitat* to determine the pest control method.
- Large areas that are totally infested can be mowed. Areas that are interspersed with invasive pests require more selective procedures such as manual removal.
- Heavy equipment or manual removal can be used on firm soils, but on either steep or saturated soil, use techniques that will minimize site and slope disturbance.
- Where mechanical or manual removal is neither possible nor practical but control is essential, careful and selective use of an approved herbicide is permitted. The list of approved herbicides is limited to Roundup Pro®, Rodeo® or Garlon 3A®. The use of these products shall conform to those BMPs described below in "Herbicide Use."
- Reestablishing a new native planting regime as quickly as possible following the removal of invasive plants is critical to successful forest restoration. These new plantings will require care for several years to guarantee establishment.
- Preserve established native plants when possible rather than reestablishing new plants after the clearing of invasives.



### Herbicide Use

The use of herbicides in any natural environment must be carefully considered. Herbicides will be used for weed control in natural areas only when other control

measures have been tried and have failed or when past practice strongly indicates that control of the weed pest can only be achieved through the use of a herbicide. The following are DPR herbicide use practices:

- Cut and stem treatment (daubing or painting) is the preferred choice for natural area management.
- Certain invasive plants are difficult to treat and control in their mature form. If possible, remove existing growth manually or mechanically. Wait for new growth to become established, and then treat with the appropriate and approved herbicide.
- Herbicides approved for use in natural areas are limited to Roundup Pro®, Rodeo® (near aquatic habitats), or Garlon 3A®.



### Exotic Insects

Insects like the European and Asian gypsy moth and the Asian long-horned beetle can potentially devastate Seattle's urban forest. City of Seattle departments will cooperate with state and federal agencies in their monitoring and control programs to prevent the introduction of these pests.

### Nuisance Wildlife



Mountain beavers, beavers, opossums, raccoons, waterfowl and other species can be destructive to natural areas when their activities are excessive. If control of wildlife is needed, DPR will work with the most appropriated City (Animal Control) or State (Department of Wildlife) agency to gain control.

### Root Rots

Even native forests can have serious disease problems. Root rots are the most serious, often killing significant trees. Several strategies help control root rot in forests:

- inoculate with mycorrhizae
- remove infected wood
- plant resistant varieties
- treat hemlock stumps with borax
- do not change site conditions on mature trees.

### 9.10 Training



Slopes greater than 40% require special practices to ensure worker safety and environmental protection. Depending on field conditions, workers may need training and supervision in proper belay equipment and techniques, as standardized in ANSI Z. These include the following topics:

- arboricultural technology and techniques
- IPM in practice
- onsite research
- invasive plant control techniques
- bioengineering of slides
- stream bed and bank protection
- structures engineering
- inventory and evaluation of woodlands
- storm damage.

# Appendix A

SEATTLE DEPARTMENT OF PARKS AND RECREATION

**Water Shortage Contingency Plan for Drought and  
Emergency Demand Reduction  
1995**

# **SEATTLE DEPARTMENT OF PARKS AND RECREATION**

## **WATER SHORTAGE CONTINGENCY PLAN FOR DROUGHT AND EMERGENCY DEMAND REDUCTION**

RESPONSE TO THE SEATTLE WATER DEPARTMENT  
1993 WATER SHORTAGE CONTINGENCY PLAN

AUGUST 1995

WATER.DOC

**SEATTLE DEPARTMENT OF PARKS AND RECREATION  
1995 WATER SHORTAGE CONTINGENCY PLAN**

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## **SECTION 1**

### **INTRODUCTION**

This plan provides a systematic response, should the need arise, for the Seattle Water Department (SWD) to reduce customer demands due to a water supply emergency or a drought event. Emergencies require more immediate and dramatic demand management measures than progressive drought situations; therefore two parts to the response plan have been developed. It is designed to be used during highly unusual and infrequent events, and is not intended for use as a substitute for developing water supply projects or long term conservation programs.

This document is an adaptation of the SWDs' 1993 Water Shortage Contingency Plan (WSCP). The narrative and action item sections, intended for City Departments and direct customers, of the initial SWD Plan have been modified to specifically address Seattle Department of Parks and Recreation (DPR) personnel and facilities only.

#### Objective of WSCP

The objective of this WSCP is to establish actions and procedures for managing water demand and evaluating supply options during a water supply emergency or drought-related shortage. The plan establishes a strategy in advance of actual conditions so that, in the event such conditions occur, the Seattle DPR is prepared to maintain essential public health and safety and minimize adverse impacts on economic activity, environmental resources and the region's lifestyle.

## **SECTION 2**

### **OVERVIEW OF DROUGHT MANAGEMENT**

Droughts are naturally occurring but unpredictable weather events with varying frequency, duration and severity. One key method used to identify the beginning of a drought period is to compare current conditions to those during previous droughts. In the region served by the Seattle Water system, available data indicate a very low probability of a multi-year drought. These data include weather records collected for the past century as well as analysis of tree rings, soil samples, and other data. As indicated below, the region has experienced short-term droughts.

The Seattle Water system assumes annual refill and drawdown of its water supply storage reservoirs. Highly unusual weather events effect this cycle and can cause potential shortages. These weather events fall into two categories. One type of weather situation causes lower than normal inflows into storage reservoirs (e.g., lower than normal precipitation and/or snowpack) so that by the beginning of the summer peak consumption period, the reservoirs are not full and there is not adequate supply to meet normal summer demands. This type of potential water shortage can be recognized and acted upon early in spring.

The other weather pattern that can cause a potential water shortage is during a summer of sustained higher than normal temperatures and lower than normal precipitation both of which contribute to above normal demand and an accelerated reservoir drawdown.

#### Regional Drought Experiences

The Seattle Water system has experienced two very different types of droughts in recent history. In 1987, although the storage reservoirs were at normal levels as of June 1, the summer weather was unusually warm and dry. Because of the warm and dry weather, outdoor water use was substantially above normal, which accelerated the drawdown of

the storage reservoirs. To reduce demand, in early August lawn watering was restricted to no more than every three days and customers were urged to voluntarily curtail other water uses. These actions reduced demand by approximately 10 percent. In early fall, an emergency pumping station was installed at the Chester Morse Lake reservoir to pump "dead storage" should the reservoir level fall below the lake's natural outlet.

Throughout the fall, precipitation continued below normal; the water supply system was managed and adjusted to obtain the maximum supply available (e.g., relying more heavily on Lake Young). In November and January 1988, the Chester Morse reservoir was low enough to require pumping and it wasn't until February 1988 that precipitation returned to normal and began refilling the storage reservoirs.

In 1992, the system experienced a very different type of drought. Because the winter was unusually warm, snowpack and flows into the storage reservoirs were at record low levels. In late February, it was evident that there was insufficient snowpack to fill the storage reservoirs and that the likelihood of recovery by June 1, due to rainfall, was minimal. A number of measures were taken to maximize available supply (e.g., reducing system flushing, adjusting stream flow levels, etc.) and to reduce demand.

In May 1992, a number of mandatory curtailment actions were implemented region wide, including banning lawn watering, resulting in an average of 25 to 30 percent below normal consumption throughout the summer.

#### Alternative Water Supplies During Drought Conditions

Based on the nature and timing of a potential water shortage, Seattle Water will pursue the feasibility of activating short-term alternative water supplies to supplement existing supplies. The Seattle DPR will make every effort to incorporate available alternative sources in operational plans.

- **Reclaimed water** Using highly treated effluent instead of potable water for irrigation, street washing, construction purposes, etc. can reduce demand for potable water and

lessen the impact of the shortage on the community. Currently, there are some significant constraints on using reclaimed water during a shortage, e.g. availability and the costs and safety of trucking water over distances. This WSCP calls for making reclaimed water available for tanker trucks only in the most severe conditions. It is important to note, however, that as reclaimed water becomes more widely available in the region, future WSCPs will rely more heavily on it as a back-up supply for non-potable uses during a shortage.

- **Non-potable sources (springs and wells)** The department has a number of naturally occurring springs and wells. Tapping into these resources for irrigation, street washing, construction purposes, etc. can reduce demand for potable water and lessen the impact of the shortage on park operations. Again, there are some significant constraints on using non-potable water during a shortage, e.g. availability and environmental regulations.

#### Curtailment vs. Conservation

There are important differences between long term conservation messages and programs and curtailment actions. Curtailment actions are designed to quickly reduce water use, are relatively short lived and usually involve some tradeoffs or hardship for customers. Long-term programs are structured to encourage customers to gradually reduce waste and increase water efficiency. What's more, the focus of the public message and information strategy shifts. The long-term message of encouraging an environmental ethic and saving money shifts during droughts to a more personal message such as "if everyone cuts back, we will have enough water for your essential needs".

### **SECTION 3 THE DROUGHT CURTAILMENT PLAN**

This plan provides a tailored approach to a water shortage. As progressively more serious conditions occur, drought curtailment measures are applied through the following stages: Advisory, Voluntary, Mandatory or Rationing stages.

In the "Advisory Stage", customers are informed as early as meaningful data are available that weather conditions may result in a less than normal available supply of water. Thereafter, if supply conditions worsen, the plan moves to the "Voluntary" stage, which relies on the voluntary cooperation and support of customers to meet target consumption goals; water users are given the responsibility to contribute their "share" of savings to reach a region wide consumption goal. Only when consumption goals are not achieved, is the next stage of the plan, "Mandatory Restrictions" implemented.

Worsening conditions would result in a "Rationing" stage.

Movement into and out of these stages and the level of targeted consumption goals will be evaluated by the Seattle Water Department Shortage Management Team.

## **ADVISORY STAGE**

In the "Advisory Stage", customers are informed as early as meaningful data are available that weather conditions may result in a less than normal available supply of water.

### **SWD WSCP Objectives:**

- o To prepare the Department, City, relevant agencies and water users for potential water shortage thereby allowing all parties adequate planning and coordination time;
- o To undertake supply management actions that forestall or minimize the need later for more stringent demand or supply management actions.

### **Triggers:**

As presented earlier, there are a variety of weather and other conditions that may cause concern about water availability and a potential water shortage. Two of the primary conditions that would trigger an "Advisory" are as follows:

- 1) Total reservoir storage is not projected to be at standard operating capacity as of June 1, due to exceptionally low snow pack, precipitation and/or lack of carryover storage from previous year.
- 2) Total reservoir storage and predicted inflows are significantly below historical "normal" for the current time of year, and supply modeling indicates that expected demands may not be met if this trend continues or worsens.

The Advisory is withdrawn when projected reservoir storage trends follow the normal water supply conditions.

**Public Message:**

"Potential exists for lower than normal supply; conditions may return to normal or, later on, we may need to reduce consumption. We'll keep you informed."

<p style="text-align: center;"><b>SEATTLE DEPARTMENT OF PARKS AND RECREATION ADVISORY STAGE ACTIONS</b></p>
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**Communication Actions:**

- o Facilities Maintenance Division Director appoints Shortage Management Team to meet as often as appropriate to evaluate conditions, determine actions and make assignments.
- o Establish systematic communications with Superintendent and Directors; Shortage Management Team communicates the nature and scope of Advisory measures and strategy to Facility and program Managers.
- o Brief Superintendent
- o Brief Division Directors
- o Brief Parks Engineer
- o Brief Parks Resources Managers
- o Brief Facilities Maintenance Manager

**Internal Operating Actions:**

- o Generate and circulate messages that inform staff and public; ask for their cooperation
- o Intensify data collection actions (water consumption data) and monitoring weather forecasts.
- o Intensify efforts to identify and repair leaks.
- o Establish a "Water Watch" alert
- o All lawn and turf irrigation must be on an as needed basis
- o Initiate planning and preparation for Voluntary Stage actions.

## **VOLUNTARY STAGE**

If supply conditions worsen, the plan moves from Advisory stage to the "Voluntary" stage which relies on the voluntary cooperation and support of customers to meet target consumption goals; water users are given the responsibility to contribute their "share" of savings to reach a region wide consumption objective.

### **SWD WSCP Objectives:**

- o To maintain or reduce demand to meet target consumption levels by customer voluntary actions
- o To forestall or minimize need later for more stringent demand or supply management actions
- o To minimize the disruption to customers' lives and businesses while meeting target consumption goals
- o To maintain the highest water quality standards throughout the shortage

### **Triggers:**

The "Voluntary Stage" is implemented when one or more of the following factors applies:

- 1) Supply conditions identified in the Advisory Stage have not improved;
- 2) Demand levels indicate that a more systematic response to managing the situation is called for

### **Public Message:**

"We are relying on support and cooperation of all water users to stretch the available water supply. Demand needs to be reduced by \_\_\_\_\_. Customers are responsible for determining how they will meet that goal. Water waste is not allowed. If everyone cooperates, we may avoid imposing more stringent restrictions. In addition to meeting essential water needs of customers, meeting the needs of fish habitat and other environmental concerns is a priority."

<p style="text-align: center;"><b>SEATTLE DEPARTMENT OF PARKS AND RECREATION VOLUNTARY STAGE ACTIONS</b></p>
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**Communication Actions:**

- o Establish systematic communications with Superintendent and Directors; Shortage Management Team communicates the nature and scope of voluntary measures and strategy to Facility and program Managers.
- o The Shortage Management Team will meet frequently to re-evaluate the situation based on current and projected supply conditions and determine the appropriate actions and strategies. The Team will determine target consumption goals to be achieved on a voluntary basis, which may be revised as necessary.
- o The Shortage Management Team evaluates whether targeted consumption levels and supply conditions warrant a shut down or closure of Park's facilities; makes recommendations to Superintendent.

**Internal Operating Actions:**

- o Continue actions listed in the Advisory Stage
- o Eliminate all water uses determined not to be essential to maintain water quality or animal health
- o Issue a request that non-recirculating fountains be turned off
- o Evaluate ability to accelerate or enhance or expand long term conservation programs; implement as appropriate
- o Request that Divisions who have alternative sources utilize them
- o Initiate remaining planning and preparation for Mandatory Stage.
- o Generate and circulate messages that encourage the following:

**Indoor Facilities**

- o Flush the toilets less often. Each flush uses 1.6 to 7 gallons of water depending on age of toilet.
- o Use dish and clothes washing machines only when full. Each load uses 15 to 40 gallons. Front loading washing machines like those found in Laundromats use approximately 30% less water than residential top loading models.

- o Avoid situations where staff or patrons run the faucets to keep water cool; Keep drinking water cold in the refrigerator.
- o Take shorter showers; for every minute of reduced showering time, 2 1/2 to 5 gallons is saved.
- o Don't let the faucets run while shaving, brushing teeth; when washing vegetables, use a pan or bowl of water instead of letting water run.
- o Wash equipment less often; instead of using the hose consider a commercial car wash that recycles water.
- o Always use shut-off nozzles.

### **Outdoor/Landscape**

- o Water lawns and gardens only early in the morning or late in the evening to reduce evaporation.
- o If it is raining don't water lawns.
- o Eliminate outdoor water play, i.e., running through the sprinkler, plastic water slides.
- o Cut wading pool back to half full.
- o Eliminate all hosing of sidewalks, driveways, decks.
- o Water established plants only when necessary: use the "finger test" to see if the root zone is dry. Mulch--from two to four inches--in planting beds will help retain moisture.
- o Create tree wells around trees to minimize runoff when they are watered.
- o change irrigation clock programs to cut back on irrigation time. Equip it with a rain sensor that will override the system during rainfall.

## **MANDATORY STAGE**

Only when consumption goals are not achieved by the previous stages, is the next stage of the plan, "Mandatory Restrictions", implemented.

### **SWD WSCP Objectives:**

- o To restrict certain defined water uses in order to reduce demand to target consumption goals that have not been met through customer voluntary actions;
- o To ensure that throughout the remaining projected duration of the drought an adequate water supply exists to protect public health and safety and to balance the need for stream flows for fish habitat;
- o To minimize the disruption to customers' lives and businesses while meeting target consumption goals
- o To maintain the highest water quality standards throughout the shortage

### **Triggers:**

Progression to this stage is made by the SWD Shortage Management Team if it determines that measures undertaken in the "Voluntary Stage" are not adequately reducing demand to the targeted level and, that progressing to mandatory restrictions is necessary to forestall the potential for a serious water shortage.

### **Public Message:**

"It is necessary to impose mandatory restrictions to reduce demand because the voluntary approach is not resulting in the necessary savings. We are continuing to rely on the support and cooperation of the public to comply with these restrictions but need the certainty and predictability of restricting certain water uses in order to ensure that throughout the duration of this shortage an adequate supply of water is maintained for public health and safety and fish habitat."

<p style="text-align: center;"><b>SEATTLE DEPARTMENT OF PARKS AND RECREATION</b></p> <p style="text-align: center;"><b>MANDATORY STAGE ACTIONS</b></p>
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**Communication Actions**

- o The DPR Shortage Management Team recommends nature, scope and timing of restrictions to Superintendent and Directors.
- o Continue and enhance communication actions from Advisory and Voluntary Stages.

**Internal Operating Actions**

- o Eliminate washing fleet vehicles unless recycling car washes are used
- o Request that hosing sidewalks, driveways, parking lots, etc. be limited to situations that require it for public health and safety;
- o Have DPR field personnel "tag" observed obvious water waste such as hoses without shutoff nozzles, gutter flooding, etc. with notice that informs customer about the supply conditions and need to conserve;
- o Prohibit all irrigation--turf, lawn and garden watering--between 10:00 a.m. and 7:00 p.m.
- o Limit all lawn or turf watering to two days or one day a week, depending on target consumption goal.
- o Prohibit use of any ornamental fountain using drinking water for operation or make-up.
- o Prohibit car washing except at commercial car wash facilities that recycle water.
- o Prohibit washing of sidewalks, streets, decks or driveways except as necessary for public health and safety.
- o Limit pressure washing buildings to situations that require it as part of scheduled building rehabilitation project (e.g., painting).
- o Prohibit water waste including untended hoses without shut off nozzles, obvious leaks and water running to waste such as gutter flooding and sprinklers/irrigation whose spray pattern unnecessarily hits paved areas.
- o For purposes of dust control, water may be applied to construction areas or other areas needing to comply with air quality requirements. If reclaimed water is available, require that it be used for dust control.

- o Ballfields and playfields may be watered at the minimum rate necessary for dust control and safety purposes.
- o Set goals for reduced water use and inform employees. Give employees ideas for curtailing water use and ask them for theirs.
- o Repair all leaks and dripping faucets. Urge employees to report leaks.
- o Reduce or eliminate routine vehicle cleaning during shortage. Use local commercial car wash facility that recycles water.
- o Ensure that all hoses are fitted with shut-off nozzles.
- o Eliminate hosing used ice as a means to dispose of it.
- o Eliminate all hosing of walkways, parking lots, loading docks. Pressure washers use substantially less water.
- o Postpone routine building washing until after shortage
- o Post signs informing customers of the nature of the water shortage and ask for cooperation in reducing water use
- o Turn off all non-recirculating fountains. On windy days, where there is significant water loss, turn off all fountains
- o Accelerate the update of restrooms by replacing older toilets with 1.6 gallon per flush models.
- o limit wading pool hours to days that are forecasted to be 70 degrees or warmer (wading pools are generally emptied and refilled daily for public health reasons:
- o Automated irrigation systems may be used at the minimum rate necessary to maintain survival of. residential and commercial lawns; golf greens and tees; high priority public use areas in public parks and Seattle Center, provided: that the area/site is managed by a Seattle DPR Certified Landscape Manager or has been audited by a certified Irrigation Auditor and the area can be demonstrated to be irrigated according to an ET based irrigation schedule
- o Evaluate ability, resources, plans to move into Rationing stage; as appropriate begin preparatory measures

<b>RATIONING STAGE</b>
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At this stage, SWD recognizes that a critical water situation exists. Without significant curtailment actions, a shortage of water for public health and safety will be imminent. No prior emergency in Seattle Water's history fits this description.

Commercial, multifamily and industrial users will be asked to reduce water use by a set percentage of the average of the twelve months prior to the current shortage. Emergency rate surcharges will be established to provide an additional incentive to reduce water use. The rationing plan is based on an allocation formula, i.e., customers are allocated a set amount of water and pay substantial "excess use" surcharges for exceeding the allocation.

<p style="text-align: center;"><b>SEATTLE DEPARTMENT OF PARKS AND RECREATION RATIONING STAGE ACTIONS</b></p>
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**Communication Actions**

- o The DPR Shortage Management Team recommends nature, scope and timing of restrictions to Superintendent and Directors.
- o Continue and enhance communication actions from Advisory, Voluntary and Mandatory Stages.
- o Continue all previous, applicable actions.
- o Define the problem to staff and the public as an emergency and institute formal procedures to declare a city emergency.

**Operating Actions:**

- o Continue and enhance "Water Watcher" patrols.
- o Continue actions listed in prior stages.
- o Further enhance water quality monitoring actions.
- o Make reclaimed water available to tanker trucks for street cleaning, construction projects, landscape irrigation, dust control, etc.
- o Close down pools

## **SECTION 4**

### **EMERGENCY CURTAILMENT PLAN**

Although many of the demand reduction measures are similar, emergencies are distinct from droughts because of the lack of preparation time and the urgency of large-scale (meaningful) demand reductions. Each emergency scenario is different, but most of them require major curtailment actions by customers. Also, unlike drought, some emergencies would be localized, requiring demand reduction only for a small geographic area.

Strategies for dealing with emergencies have been developed and Outlined in the City's Disaster Preparedness and response Plan. Refer to the DPR disaster Response plan for emergency actions.

<b>ATTACHMENTS</b>
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<b>CONTACT LIST</b>
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The WSCP contains a list of contacts for easy reference in case of a drought or emergency. In addition to the communication elements contained in the WSCP, the following will be contacted directly in the event of a drought or emergency to inform them and ask for their support and cooperation in reducing demand. The list will be updated annually.

# Appendix B

CITY OF SEATTLE OFFICE OF ENVIRONMENTAL MANAGEMENT

**Environmental Management Initiative**

**"Chemical Use" (Section 6.3)**

**1997**

## **6.3 CHEMICAL USE**

### **6.3.1 Purpose**

The purpose of this policy is to establish a chemical use program to ensure consistent evaluation of hazardous materials used by City employees, to phase out products that pose human health or environmental risks, and to promote the use of non-hazardous alternatives by the City that are protective of human health and the environment.

In short, the purpose is to:

- Know what chemicals are being used;
- Make conscious decisions about the chemicals selected for use;
- Use chemicals wisely; and
- Make full use of chemicals bought.

### **6.3.2 Organizations Affected**

All City departments that purchase and use hazardous materials are affected.<sup>1</sup>

### **6.3.3 Definitions**

Hazardous Material: A chemical or mixture that can pose a physical hazard, health hazard, or environmental hazard and that is regulated under the law to control its harmful effects. This definition is not intended to be rigid or legalistic because all materials regulated in this manner merit special attention and consideration by the City under this policy.

Hazardous Waste: Those solid wastes that are designated by 40 CFR Part 261 or WAC 173-303 as moderate risk, dangerous, hazardous, or extremely hazardous waste.

### **6.3.4 Policy**

Hazardous materials shall be used, stored, transported, and disposed of in compliance with all applicable laws and regulations.

In designing, constructing, and maintaining City facilities, and in designing and conducting the City's operations, departments shall give priority to minimizing the need for hazardous materials. Consideration will be given to options such as process changes, product changes, improved operations and maintenance, modernized processes and/or equipment, closed-loop recycling, and material substitutions.

When a hazardous material is needed, the amount purchased and used shall be the smallest quantity practical. Recognizing that the purchase price of a

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<sup>1</sup> This policy does not apply to abandoned hazardous materials found on City property, household hazardous waste collected by Seattle Public Utilities, criminal evidence gathered by Seattle Police Department, and other materials received by the City but not within our control.

product does not reflect its true cost to the City, use of large quantity discounts, bulk container purchases or minimum order requirements that exceed departmental needs should be discouraged when procuring hazardous materials.

City departments shall participate in annual interdepartmental efforts to inventory all hazardous materials used per year and to develop and maintain a Citywide chemical management information system on hazardous materials usage.

Upon completion of each annual Citywide inventory of hazardous materials usage, the following general criteria shall be used to designate certain hazardous materials for phase-out from City inventories and limitation of new product purchases:

- Do they pose as a human health risk?;
- Do they pose as an environmental risk?;
- Are they legally disposable?;
- Does their use create Extremely Hazardous Waste, which is hazardous waste that is classified as “Extremely Hazardous Waste” under WAC 173-303-100 and has a quantity exclusion limit of 2.2 pound per month?; and
- Is the use, emission of, or discharge to air or water highly regulated?

Any product containing hazardous materials that is not listed on a department’s inventory shall not be purchased or used by that department without prior review to determine whether the product meets the City’s health and environmental criteria.

When selecting replacements to hazardous materials targeted for phase-out, and in approving new products for use, departments shall place highest priority on protecting worker health and safety, protecting public health, and protecting the environment. The next level of priority to be considered includes product effectiveness and cost effectiveness.

Where hazardous materials are used in equipment serving functions vital to the City’s operations, and the City has made significant investment in the equipment in which the chemicals are used or there are no satisfactory replacements, it is recognized that phase-out of those hazardous materials may not be immediately practical. Examples include fire suppression systems charged with halons, refrigeration or air conditioning systems using chloroflourocarbons, and electrical equipment filled with PCB-containing transformer oil or sulfur hexafluoride gas. In those cases, departments shall develop and implement best management practices to minimize the quantity of hazardous materials required, protect worker health and safety, and minimize release of hazardous materials to the environment. Such best management practices may include, for example, preventive maintenance procedures, use of leak detection methods or equipment, and use of recapture or closed-loop recycling systems.

When appropriate, excess hazardous materials should be returned to the supplier when that is an option, or offered for use by other City departments or elsewhere per the City Recommended Guidelines for Surplus of Hazardous Materials and ESD Administrative Rule 97-1 Regarding

Disposition of Surplus Materials, Supplies and Equipment Other Than Real Property.

### **6.3.5 Procedures and Responsibilities**

#### **6.3.5.1 Developing and Conducting Annual Hazardous Materials Inventory**

The Office of Environmental Management (OEM) shall coordinate development of a Citywide format for an annual comprehensive inventory of hazardous materials usage.

Department directors shall ensure that departments participate in Citywide planning for the inventory, conduct the inventory, and report the information in the specified format.

Upon completion of the initial inventory, each product identified on the inventory list shall be approved for use unless it has been identified for phase-out and a replacement option has been approved per Section 6.3.5.2.

#### **6.3.5.2 Phasing-out Targeted Chemicals**

Each year, the OEM shall compile data from the annual Citywide inventory and work with departments and, where applicable, user groups,<sup>2</sup> to refine chemical phase-out criteria, develop a Citywide prioritized list of chemicals targeted for phase-out, and establish a work plan including tasks and schedules for phase-out of chemicals.

Department directors shall ensure that departments participate in Citywide efforts to establish the annual phase-out list and annual work plan. Directors will also incorporate elements of the Citywide work plan into departmental work plans.

In addition to the chemical phase-out criteria, the OEM shall develop guidelines for evaluating replacement options for the products targeted for phase-out.

The OEM shall facilitate interdepartmental user groups in evaluating their hazardous materials usage. The OEM shall assist user groups and, where applicable, individual departments in researching alternatives to products targeted for phase-out.

Department directors shall ensure that departments participate in interdepartmental efforts as needed to phase-out targeted hazardous materials. Directors shall also evaluate proposed alternatives per guidelines developed by the Office of Environmental Management.

#### **6.3.5.3 Reviewing Requests for New Products<sup>3</sup>**

Any product containing hazardous materials that is not listed on a department's inventory shall not be purchased or used by that department

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<sup>2</sup> We anticipate that, in many cases, hazardous materials targeted for phase-out will be associated with user groups that are common to multiple City Departments. Potential user groups may include, for example, landscapers, painters, and custodians.

<sup>3</sup> This refers to requests for new products that are initiated by employees, independent of the process to identify replacement products for chemicals scheduled for phase-out.

without prior review to determine whether the product meets the City's health and environmental criteria.

Department directors shall ensure that departments have internal procedures to review requests for new products using guidelines established by the Office of Environmental Management and to prevent unauthorized use of new hazardous materials that have not been reviewed, or have been reviewed and rejected.

Department directors shall ensure that new products approved for use are added to the department's inventory list.

New products, approved for use within each department review, shall be subject to review for consistency with City criteria by the OEM upon completion of the next annual inventory. The Director of the OEM, in consultation with the City Safety Office and/or the applicable user group, shall make the final determination on product acceptability before such products are added to the permanent inventory of approved products.

#### 6.3.5.4 Reviewing and Revising Procurement Procedures

The Executive Services Department (ESD) shall review procurement practices to ensure that they are consistent with this policy, including an assessment of:

1. Standards for size and quantity of materials to be purchased under City contracts, including minimum order requirements, unit sizes, and quantity discounts;
2. Standards for type of materials available under City contracts to restrict availability of chemicals targeted for phase-out;
3. Standards requiring vendors to accept return of unused products;
4. Existing Blanket Contracts which are high priority for revision or replacement based on factors (1) or (2) above; and
5. Current utilization of direct vouchers for hazardous materials purchases.

#### 6.3.5.5 Developing, Installing, and Maintaining the Chemical Management Information System

The OEM shall identify user requirements for a centralized chemical management information system that will be used to implement both the City's Hazard Communication Policy and Chemical Use Policy.

The OEM shall develop, install and maintain the chemical management information system and develop interdepartmental agreements on use and maintenance of the system.

Department directors shall ensure that departments comply with interdepartmental agreements on use of the chemical management information system.

#### 6.3.5.6 Incorporating Hazardous Materials Minimization into Operations

The OEM shall assist departments, as needed, in identifying alternatives and developing and implementing best management practices to minimize hazardous materials use.

Department directors shall ensure that departments incorporate measures into their operations to reduce hazardous materials use, document those measures, and develop applicable written procedures on those measures.<sup>4</sup>

#### 6.3.5.7 Involving and Training Employees

The OEM shall coordinate development of training materials to assist departments in implementing this policy.

Department directors shall ensure that departments train employees on departmental policies and procedures relevant to this policy. Department directors shall also support employee involvement in identifying and implementing strategies to minimize the use of hazardous materials and in evaluating replacements to chemicals targeted for phase-out.

#### 6.3.5.8 Tracking Progress and Evaluating the Program

The OEM shall compile data on Citywide policy implementation, and make recommendations for future direction of the program.

Department directors shall report annually on progress in carrying out agreed-upon work plans for implementing this policy.

### 6.3.6 References

- City of Seattle Council Resolution 29268, December 18, 1995.
- Hazardous Materials Coordinating Committee (HMCC) Report on Council Resolution 29268, June 25, 1996.
- Hazardous Materials Coordinating Committee (HMCC) Recommended Guidelines for Surplussing Hazardous Materials, December 1997.
- State of Washington Hazardous Waste Reduction Act of 1990.
- State of Washington Pollution Prevention Plans Regulations, WAC 173-307.

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<sup>4</sup> This is based on requirements of the Washington State Pollution Prevention Plans Regulations, WAC 173-307. Departments with pollution prevention plans prepared in accordance with that regulation shall be deemed to have satisfied this requirement.

# Appendix C

CITY OF SEATTLE OFFICE OF ENVIRONMENTAL MANAGEMENT

**Environmental Management Initiative**  
**"Landscape and Grounds Management" (Section 6.13)**  
**1997**

## **6.13 LANDSCAPE AND GROUNDS MANAGEMENT**

### **6.13.1 Purpose**

The purpose of this policy is to ensure that City landscapes are designed, constructed, and maintained in a manner that protects and enhances our region's natural resources and public health; that City landscapes are models of environmental stewardship in the eyes of the public; that the City establishes a leadership role in developing both aesthetically pleasing and ecologically sensitive landscapes; and that there is a consistent standard of environmental stewardship observed by City departments managing landscapes and other grounds.

### **6.13.2 Organizations Affected**

All City departments responsible for managing construction projects or managing City-owned grounds and landscapes are affected.

### **6.13.3 Definitions**

Integrated Pest Management: A pest management process that uses monitoring to determine pest injury levels and combines biological, cultural, physical, and chemical tools to minimize health, environmental and financial risks. The method uses the least toxic synthetic pesticides only as a last resort to controlling pests.

Sustainable Design, Construction, and Maintenance: Principles, materials, and techniques that conserve natural resources and improve environmental quality throughout the life cycle of the landscape and its surrounding environment.

Landscapes: Grounds that are actively managed such as parks, library lawns, right-of-ways, in-town watersheds, etc., but not large tracts of forest land like the Cedar River Watershed.

Water Budget: A set of month-by-month estimates of irrigation water use for a specific landscape taking into account plant material, soil type, type of irrigation system, and average weather conditions. The annual budget is the sum of all the monthly budgets.

Evapotranspiration (ET): The sum of the water lost from the soil surface and water use by plants.

### **6.13.4 Policy**

In planning, siting, designing, constructing, and maintaining grounds and landscapes owned and managed by the City, site objectives shall include management and maintenance practices that protect and enhance natural ecosystems. City grounds designers, planners, managers, crews, and their contractors shall give priority to:

A. Maximizing water use efficiency (see Energy and Water Conservation Policy);

- B. Practicing the principles of Integrated Pest Management including the reduced use of pesticides (see also Chemical Use Policy);
- C. Reducing and reusing landscape waste materials through practices such as mulch mowing, mulching and composting;
- D. Selecting and using fertilizers that minimize negative impacts on soil organisms and aquatic environments;
- E. Designing new and renovating existing landscaped areas to suit the site conditions and with sustainable maintenance in mind. For example:
  - Using proper soil preparation and amendment;
  - Specifying weed-free soil amendments;
  - Using mulches to control weeds, conserve water, and build healthy, biotically diverse soils;
  - Using site adapted and pest resistant plants: “the right plant for the right place”;
  - Grouping together plants with similar horticultural needs;
  - Retaining and using regionally native plant material where appropriate;
  - Controlling noxious weeds and invasive, non-native, plant species;
  - Planting for erosion and weed control;
  - Assessing whether landscapes can still meet the intended site use objectives while modifying the aesthetic standard and/or applying less maintenance; and
  - Matching maintenance standards to site objectives in the design stage.
- F. Restoring, creating, and protecting environmentally valuable areas such as wetlands and riparian, aquatic, wildlife, forest, and meadow habitats. Protection shall include avoiding developing these areas whenever feasible.
- G. Increasing the City’s tree canopy. Trees contribute numerous environmental benefits including reducing the build-up of atmospheric carbon dioxide; absorbing atmospheric pollutants; and slowing the rate of precipitation which allows increased infiltration and reduced run-off, slope stabilization, and wildlife habitat.
  - City departments responsible for open space and public rights of way shall give priority to:
    - (a) Significantly increasing the number of trees in rights of way and open spaces;
    - (b) Replanting in parks and open spaces where trees are mature and nearing the end of their life cycle;
    - (c) Working with community and neighborhood interest groups to involve them in planting and maintaining the urban forest.
  - City departments managing construction projects shall give priority to incorporating into the construction design any existing, healthy, mature trees on the building site or, alternatively, to moving such trees.

#### **6.13.5 Procedures and Responsibilities**

City departments responsible for managing landscaped areas shall provide training to grounds management and maintenance staff. The purpose of the training is to acquaint staff with this policy and to keep staff current with best landscape-management practices and technologies.

City departments responsible for managing landscaped areas shall prepare water shortage contingency plans for water shortage events such as droughts.

City departments shall implement procedures that ensure that contractors and vendors are knowledgeable about and comply with this policy.

In making landscaping staffing and budget decisions, departments shall consider the potential environmental tradeoffs; for example, will reduced staffing require increased use of pesticides to maintain the landscape at the same standard?

An interdepartmental Grounds Management Committee shall meet regularly to coordinate activities, share resources, plan training, exchange information, set goals, evaluate progress, and periodically review this policy and update it as necessary.

Designs for new or renovated landscapes shall include maintenance plans, which shall conform to the requirements of this policy. Pesticides shall be selected using the guidelines provided in the Chemical Use Policy. City departments responsible for grounds management shall establish a water budget for all irrigated landscapes larger than 0.5 acres that are not controlled by ET based systems.

Landscape design, installation, or maintenance contracts shall require contractors and vendors to comply with this policy.

Department heads shall be responsible for:

- Ensuring that departmental procedures, budget, and staffing decisions support implementation of this policy;
- Providing training to grounds management staff in the requirements of this policy; and
- Appointing a staff person to the Grounds Management Committee to represent the department on matters related to this policy.

The Office of Environmental Management (OEM) shall be responsible for:

- Providing staff support to the Grounds Management Committee; and
- Facilitating interdepartmental resource sharing.

#### **6.13.6 References**

- City of Seattle, *Landscape and Grounds Management Guidelines: Environmental Stewardship* (1999).
- Related Policies: Energy and Water Conservation Policy and Chemical Use Policy.